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THE PORT OF ISTANBUL

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Throughout the period when the small Greek colony of Byzantium grew into the great imperial capital of Constantinople (now Istanbul), its fortunes have been closely bound up with the prosperity of its port. From Byzantine times, when this port was one of the great commercial centres of the world, until the second half of the nineteenth century, the excellent natural harbour was able to accommodate easily all the shipping that the city attracted. The problem of congestion emerged only in the last years of the Ottoman Empire and to-day it is clear that the port has hopelessly outgrown its former well-endowed water site. What follows is an attempt to present some of the geographical factors underlying the problem and to note some recent ideas about its solution.

Istanbul stands at one of the most important historical 'cross roads' in the world. At the Bosphorus Europe meets the Orient, and the 'Heartland' has access to the oceans. The city became an unrivalled collecting centre for the diverse products of far-flung lands. In the sixth century A.D. Chinese silk, Malabar pepper and Indian copper came from the east; from the north came furs, skins and slaves; from Europe jade, amber and iron; from the south incense, gold, grains and wine; and from distant Africa gold, ostrich feathers and ivory.

The volume of trade varied with vicissitudes of political geography, and to-day the tight economic controls at international frontiers to north, east and west have virtually destroyed the commercial 'cross roads'. Instead the port looks south and thrives on Turkey's increased trade with the outside world. The country is a firm adherent to NATO and in consequence the port's strategic position at the outlet of the Black Sea has acquired a new importance.

The great city clusters around the southern end of the Bosphorus, a drowned river valley some nineteen miles in length, averaging a mile in width and 180 feet in depth. The Golden Horn of the European shore,

Istanbul's traditional harbour, is a drowned tributary valley of the Bosphorus five miles in length (see Fig. 1). Its head streams, the Alibey and Kağithane, rise within three miles of the Black Sea coast and drain a catchment long subject to soil erosion. Water thus divides the urban mass into three land sites : Old Istanbul, Beyoğlu and Üsküdar-Kadiköy — all dense concentrations of population which present serious problems of intercommunication. Connecting the Bosphorus' shores are sixty-two hard-worked ferryboats, whose bustling presence in the main harbour hampers the working of merchant ships. Connecting Beyoğlu and the old city are two pontoon bridges. The need for these is apparent from the throngs using them both, and especially Galata Bridge, during the daytime. Unfortunately, by severing the Golden Horn from the sea, they and earlier structures were the chief cause of its decay as a harbour.

The Golden Horn has been a superb natural harbour. Like the Bosphorus it lies entrenched in a plateau which here stands at the modest elevation of 100 to 300 feet. 'Drowning' occurred when the collapse of great land masses to north and south in Early Quaternary times left the Thracian promontory upstanding and unstable; it then tilted to the south, drowning the Marmara coast. The Golden Horn thus produced has a depth of 100-140 feet in its lower half. Despite steeply sloping land, almost everywhere there is a 'strandflat' bench at sea level. This feature is apparently artificial, and results from the continual dumping of refuse in the water. As the bench has extended, it has narrowed the Horn by between 20 and 200 yards since Byzantine times.

Half-way up the Golden Horn, in the Balat-Hasköy narrows, the deep water quite suddenly gives way to shallows of nine or ten feet. Here are met the advancing deposits of the Alibey and Kağithane streams, which have swept commerce out of the upper half of the Golden Horn. Although accelerated erosion may have started 2,200 years ago with the exploitation of the land in Seleucid times (a parallel development occurred at several ancient Anatolian ports, *e.g.*, Ephesus, Miletus and Tarsus), the rapid ruin of the water site of the Golden Horn appears to be quite recent. In 1912 ships carrying coal from the Black Sea coast were able to sail right up to a power station at the head of the estuary, and any ships plying the squally Black Sea coast must necessarily be of fair size. It was not until the early-'twenties that they had to give up on account of alarming silting. To-day even the shallow-draft ferryboats must be expertly navigated to reach Eyüp safely, and the Eyüp and Sütlüce ferry stations were closed on November 29th, 1959, at the beginning of dredging operations (costing £800,000) to make a safer channel for the boats.

Sultan Mehmet II, the Ottoman Conqueror of 1453, recognised the danger to the Golden Horn and initiated laws controlling agriculture and forest cutting in the catchments of the Alibey and Kağithane streams, which were observed until the decline of the Ottomans. Relaxation of this control in later years gave soil erosion a new vigour. Thousands of Albanian refugees were settled at Ok Meydani on the north shore in 1923 and allowed such freedom of activity that the soil was exhausted, and much of it found its way into the murky waters of the Golden Horn. Sedimentation has continued unabated and, together

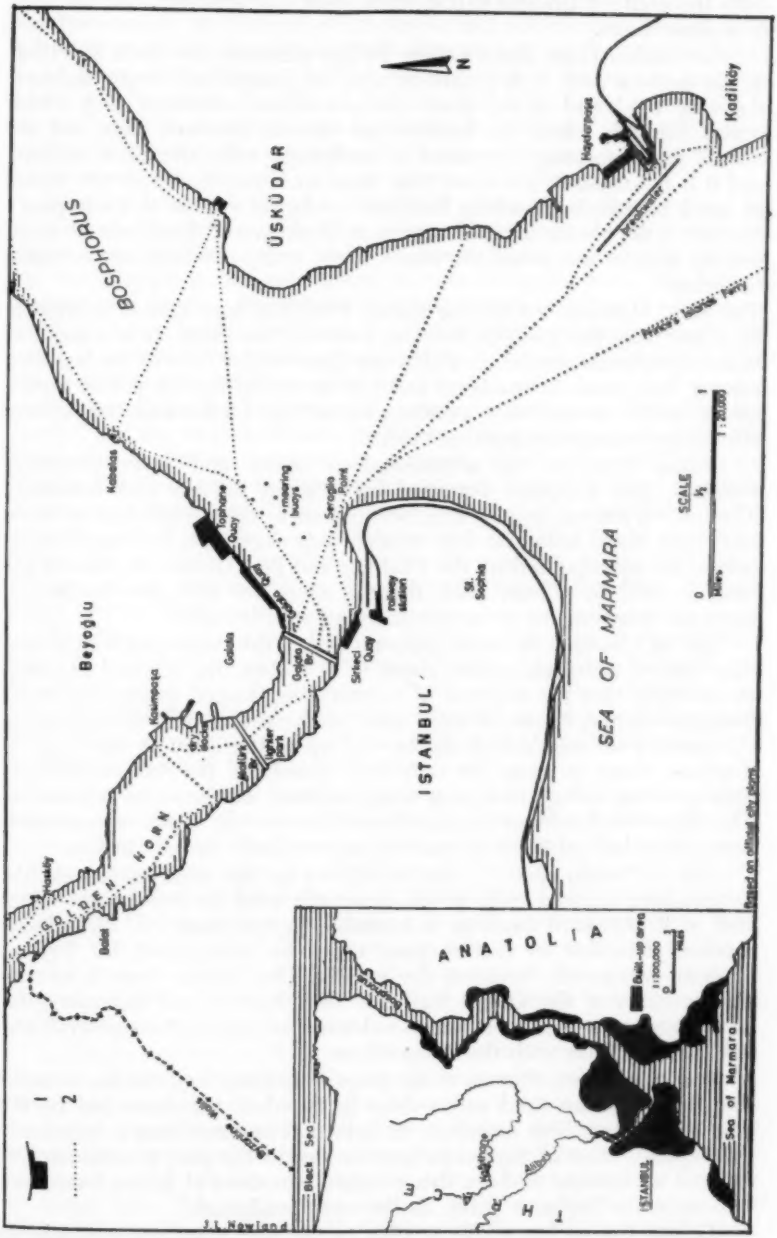


Fig. 1. The port of Istanbul : 1. main quay and warehouse areas; 2. ferry routes.

with the pontoon bridges dating from 1839, has sentenced the harbour to a slow death.

The Golden Horn above Galata Bridge performs five main functions in the modern port. It is a parking area for loaded and empty lighters, the very life-blood of the port. The occasional merchant ship which passes through when the bridges are opened between four and six o'clock each morning, is worked at anchorage with attendant lighters, and it is not usual to see more than three such vessels. There are scores of small boatyards, repairing facilities for larger vessels at Kasimpaşa's two small dry docks, a naval station at Hasköy, and hundreds of small private warehouses lining the south shore, many of which serve textile factories.

The Main Harbour outside the Galata Bridge is here limited arbitrarily by a line from the Seraglio Point to Kabataş Car Ferry. It is a scene of chaotic perpetual motion, in which one fears for the lives of the boatmen rowing their loads of mackerel and melons to the buying public on the quays, while miraculously avoiding ubiquitous ferries and the lighters attending ocean-going merchant ships.

Galata Quay is the administrative centre and main passenger terminal, and is rather cramped by a steep hillside and buildings. The quay is 800 yards long with twenty-four to thirty-eight feet of water alongside, there being no tide to alter this depth. Its two small warehouses are monopolised by the Customs and Post Office. As some of the quay is used by a busy road, there is space for only five berths and these are reserved for passenger-carrying vessels only.

East of Galata is the new Tophane Quay, 350 yards long with thirty-nine feet of water alongside. Here, as at Galata, the sea-bed descends so abruptly that the expense of constructing 'finger' quays has so far been prohibitive; hence all ships must berth parallel to the shore, limiting the number of vessels that can be tied up to the quay at one time. At Tophane there is room for only five vessels of the 5,000-10,000 net tonnage class, though its warehousing facilities are the finest in Istanbul. The shore bench widens appreciably so that two big warehouses are now being built behind the four modern import sheds already in use.

The last main quay is that of Sirkeci on the south shore. As the eastern and western ends of the quay are used by ferryboats, only a half of its 400-yard frontage is available to merchantmen, these being moored stern-first so that cargoes must be transferred by lighters working awkwardly between the vessels. The Sirkeci Quay is next to the terminus of the Orient Railway from Europe and has two great advantages over the other quays—rail-transport connections and rail and vehicle-ferry links with the Asian Shore.

It is clear, then, that there are proper berthing facilities for no more than five medium-sized cargo ships in Istanbul, supplemented by the five or six stern-first moorings at Sirkeci. This provision is hopelessly inadequate. Most of the cargo transference in the port is conducted at buoyed anchorage, and for this purpose two rows of buoys have been laid opposite Tophane Quay, in the open roadstead.

Galata Bridge has a rôle to play in the port more positive than its part in the ruin of the Golden Horn as a harbour. Five landing stages attached to the bridge, together with four on the adjacent quays, are

the base of the whole passenger-ferry fleet. Altogether these boats number seventy and their effect in obstructing commerce is considerable. A bridge across the Bosphorus would displace many of them and although many plans have been made and tenders invited during the past few years, it was only on the 27th of January, 1960, that it was announced in the press that an American firm was to begin work on a huge suspension bridge. A few months later the project was postponed indefinitely due to the weak condition of Turkey's foreign exchange.

The third zone of the port, the Outer Harbour, is characterised by pockets of activity along the coasts, by contrast with the intensive and concentrated traffic of the Main Harbour. Examples of such pockets on the Bosphorus are oil dumps at safe distances from the city, a modern coal depot, a floating dock and repair yards, while the Marmara coast has a few fishing harbours. Yet the Bosphorus remains largely unspoilt, a waterway of great natural beauty in which almost every inlet has historical or legendary associations.

Navigation in the Bosphorus is mostly a matter of knowing the current and its violent eddies. Its speed averages two knots from the Black Sea, tending to increase in summer when evaporation in the Eastern Mediterranean is at its height and the Black Sea rivers are high. It responds readily to wind direction and strength, sometimes being reversed and at other times swirling down to Marmara at six knots. Navigation is made more difficult by the eddies which are often emphasised on upwind shores by the surfacing of the deep current, which always flows north.

The fourth unit is the Port of Haydarpaşa, a small but rapidly expanding harbour serving the terminus of the Anatolian railways and dominated by a silo for the grain of the plateau. It is becoming an important Bosphorus port in its own right and could repay a separate study. Physically, functionally and administratively quite separate from the Port of Istanbul, it is not dealt with in this paper.

The port of Istanbul is suffering from a deluge of commerce upon a water site cut off by the Galata Bridge from its greatest asset, the Golden Horn. The shortage of marginal deep-water quays is the most serious defect of the port lay-out. Ships not berthed alongside the two quays available are beyond the reach of port cranes and require the use of lighters. The importance of these small craft in Istanbul is clear from the fact that they moved 790,000 tons of inward cargo out of a total of 797,000 tons in 1950; since then, this proportion has probably been reduced slightly by a slackening of international trade and the completion of Tophane Quay.

Lighters must queue while awaiting attention at the quays and there are large lighter parks in the Golden Horn in which they may remain, with their cargoes, for a fortnight or more. Valuable lighter-space is thus taken out of circulation, with the result that ships in harbour have experienced long delays while waiting for free lighters. For instance, a vessel with only 160 tons of cargo for Istanbul was once kept in port for three days. The port's trade, and its problems, reached a peak in 1951, and the North Atlantic-Mediterranean Freight Conference then placed a 20 per cent surcharge on all Istanbul cargo.

A vessel which succeeds in obtaining an alongside-berth is often

asked to vacate it before discharge or loading is completed, the reason being that the modern port cranes can only work at half speed. For the same reason, cargoes may only be slowly transferred between light-

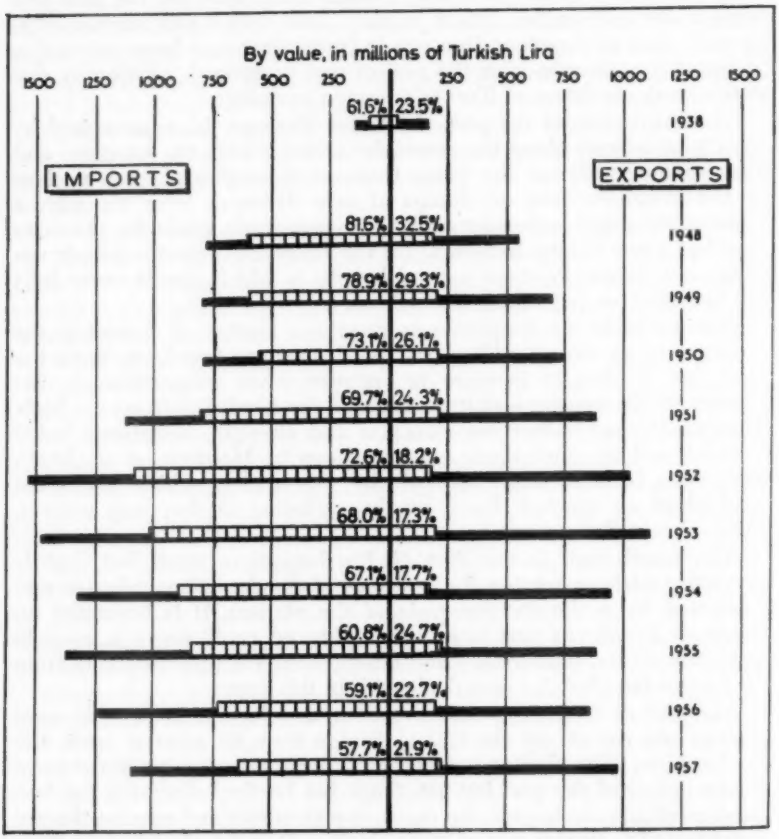


Fig. 2. Foreign trade of Istanbul (squared bar) and Turkey (black bar). *Source : Journ. Istanbul Chamber of Commerce,* 1958, 74.

ers and quay. Perhaps this is the core of the problem. The inefficient use of the cranes is unavoidable because the quays are often jammed with vehicles, crates and sacks; this state of affairs is in turn due to slow removal and overcrowded warehouses. The warehouses are not only inadequate but slowly worked—by the *hamal,* a human beast of burden. His labour is so absurdly cheap that it is difficult to replace him by pleading the economy and the speed of modern cargo-moving equipment. Istanbul is receiving more than 100,000 people a year from country areas and provincial towns, an immense influx which depresses wages, and in the port the *hamal* has been retained because he is cheap and involves no capital charge. There is evidence that this situation is now being remedied.

The import sheds to which incoming cargoes are first moved are theoretically temporary resting places pending transfer to private warehouses. But the importers treat them as warehouses and goods may stay there to clog them for months.

Such is the problem of movement within the port. It is further complicated by local climatic conditions. Istanbul stands in a zone of interaction between Eurasian continental air masses and those of the Mediterranean. Although there is little conflict in summer, in winter winds often change direction hourly. They are mostly from the north, sometimes from the south, but only rarely from any other direction. The historic harbour, countersunk as it is in the plateau, offers the maximum protection from winds and waves, particularly those of winter depressions which lash the Marmara coast. Yet when shipping was pushed into the Bosphorus it became more exposed to winds from both quarters. Fogs are frequent in winter, and average thirty-six full days a year. This is not very surprising in Istanbul, where land, air and water masses of varying temperature meet; nevertheless many are radiation fogs held in the troughs of the Bosphorus and Golden Horn by temperature inversions. The effects of high winds, high seas and fogs on the port are to hinder its working. Istanbul suffers particularly from such conditions since it depends so heavily upon small lighters. The protracted double-cargo transference becomes difficult and sometimes hazardous in bad weather.

It remains to note the effect of the port's problems as reflected in the trading figures. Istanbul overshadows all other cities in Turkey in its commercial importance, though its predominance is not quite so great as that of Copenhagen in Denmark. The city's position in the foreign trade of Turkey is shown in Figure 2. Imports predominate because many of the country's exports (tobacco 28, hazel nuts 12, cotton 9, and chromium 6 per cent, in 1957) go abroad directly through local ports, while a much greater proportion of Turkey's imports (machinery 27, mineral oil 15, iron and steel 8, medical goods 7, textiles 5, and transport means 5 per cent) enter by way of Istanbul to be re-distributed.

The effect of congestion was such that during the peak trading of the early nineteen-fifties, the port was physically incapable of taking a proportional share of the national trade, and all other ports have shown a greater expansion, particularly those of Izmir and Iskenderun.

Numerous plans have been proposed for the solution of the problems of the port. One gigantic plan is for its complete removal to virgin ground ten and twenty miles to the west, as part of a radical zoning plan involving new industrial and residential estates. Now three years old, this plan, though fully approved in principle, is being weighed against others, including one for a port along the Asian coast.

The impossibility of further expansion within the Bosphorus seems to be assumed by most planners in Istanbul, perhaps because of the failure of new Tophane Quay to do more than scratch the surface of the problem. At all the eligible sites decisions cannot be made with certainty owing to the lack of data, the great expense involved and the fear of damage to natural beauty and places with historical associations. What is certain is that after 2,500 years, the harbour first chosen by the original settlers can now no longer meet the needs of the day.

Geographical Handbook Series, Naval Intelligence Division, *Turkey*, Vol. 1, 1942.
Giordano, A. The Port of Istanbul : Development and Future Possibilities, *The Dock and Harbour Authority*, 1932-3, 13 : 101-10.
Istanbul Ticaret Odasi Mecmuasi *(Journ. of the Istanbul Chamber of Commerce)*, 1945-1960.
Masson, P., Constantinople et les Détroits, *Annales de Géographie*, 1919, 28, p. 141.
Yamanlar, O., *Studies in soil conservation in the catchments of the Alibey and Kağithane Streams*, 1957, Istanbul University, Faculty of Forestry, Publication No. 48, p. 163. (In Turkish, with English précis).

FOUR COMMONWEALTH POWER PROJECTS

The post-war decades have witnessed an ever-increasing exploitation of hydro-electric power potential in various parts of the world. Some of the largest and most important developments have been initiated in areas where alternative sources of power are limited and where there is, in addition, a need to raise very low standards of living by increased industrial and agricultural production. Already several major hydro-electrical power projects have been realised in the Commonwealth — four of which are illustrated opposite.

Kemano (British Columbia), started in 1951, supplies power to the Aluminium Ltd of Canada's smelter at Kitimat — the largest integrated aluminium project ever undertaken. A ten-mile-long tunnel reverses the westward flow of the Nechako River, impounded by the Kennedy Dam, and provides a head of 2,386 feet at an underground power station at Kemano : this is a head nearly sixteen times as great as that of Niagara. From Kemano electricity is transmitted fifty-one miles north to Kitimat.

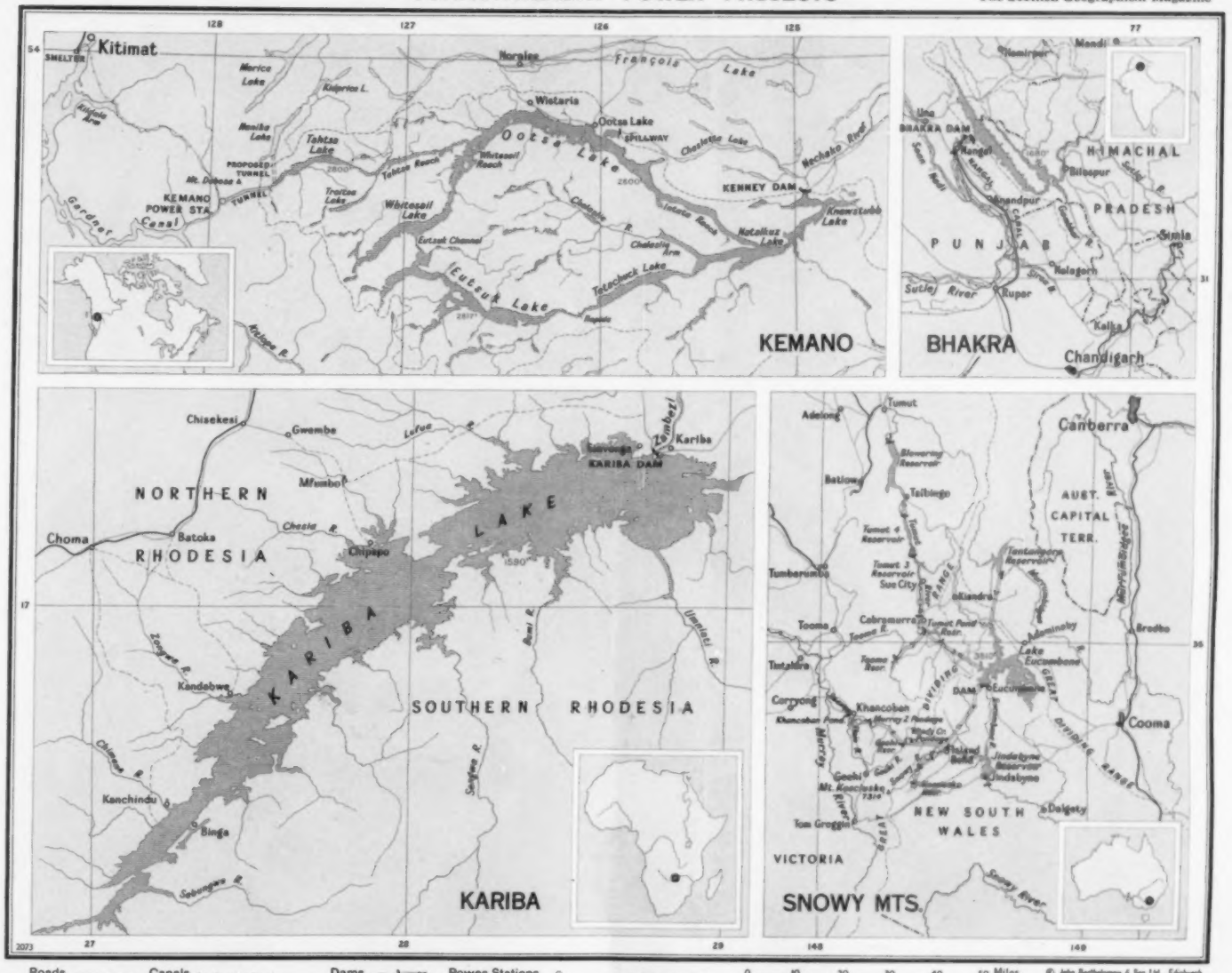
Snowy Mountains (S.E. Australia) project, the largest H.E.P. undertaking in the world, is comparable to that of Kemano. In entails the diversion, by many miles of tunnels, of the dam-impounded water of the Snowy River to the Murray River and that of the Snowy's tributary, the Eucumbene, to the Tumut tributary of the Murrumbidgee from south-east to north-west across the Great Dividing Range. Both diversions produce high heads of water and the same water is used several times in aligned series of power stations. Here the scheme has been developed primarily for the production of peak-load electricity.

Bhakra-Nangal (Union of India). This scheme has the dual purpose of producing electric power and of providing irrigation water for six million acres of semi-arid land in the Punjab. The Bhakra Dam in the Sutlej gorge impounds a lake some fifty-five miles long (this submerged 360 villages and displaced a population of 30,000). This is also supplemented by the Nangal Dam eight miles downstream from which water will eventually be diverted into the Nangal Hydel Canal and associated power stations.

Kariba (N. & S. Rhodesia). The construction of a dam at the Kariba gorge on the Zambesi River has created a lake 175 miles long with a capacity nearly five times that of the Hoover (Boulder) Dam on the Colorado River (U.S.A.). Two underground power stations, one on the north bank of the river (to be completed in 1962) and a larger one on the south bank, will eventually produce 8,500 kWh per year and will be among the lowest cost-producers in the world. As with Bhakra-Nangal this scheme will, among other things, provide an economic source of power for the further development of industry in an underdeveloped region.

The accompanying map (opposite) is reproduced from The Statesmans' Year Book, 1961, by kind permission of Macmillan & Co. Ltd.

COMMONWEALTH POWER PROJECTS



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SOLIFLUCTION IN SCOTLAND

R. W. GALLOWAY

Newbigin Prize Essay, 1961

Over the greater part of Scotland the bedrock is covered by unconsolidated drift composed of sand, clay, and stones. Most of this drift derived from the glaciers that enveloped the country during the Ice age, but some originated at a time when the land was free of ice but subject to a cold periglacial climate. [1] Under this climate the intense frost shattered the bedrock and the resulting loose debris, together with any other unconsolidated material available, such as glacial till or a preglacial weathered mantle, slowly moved down the slopes by solifluction. At the close of the Ice Age some 10,000 years ago the severe periglacial climate ceased but a milder variety persisted on high ground and still prevails there today. Solifluction can take place under a wide range of climates but it is particularly prevalent in a periglacial environment because of abundant soil moisture, scanty vegetation, and the effects of freezing and thawing in the ground.

Periglacial solifluction deposits take three main forms in Scotland :—

1. Uniform sheets of small stones, sand and clay, producing a smooth topography over extensive areas. This type corresponds to the well-known "head deposits" of Southern England.

2. Lobes and terraces, usually comprising a mixture of large and small stones in a scanty finer-grained matrix. They form steps on slopes with "risers" from a few inches to several feet high, usually aligned along the contour, and consisting of bands of dense vegetation ("turf-banked") or large stones ("stone-banked").

3. Block fields consisting of boulders scattered individually or in agglomerations over the slopes and sometimes concentrated into linear accumulations, known as stone streams, aligned along the axis of shallow valleys.

It is possible to recognise five regions each with distinctive solifluction deposits whose characteristics can be related to the effects of glaciation, the rock, the relief, and the past and present climates.

NORTH-EAST SCOTLAND

During the last Ice Age the lowlands extending from the lower Spey to the lower Don were only lightly glaciated and indeed the Buchan district probably escaped invasion by the ice. [2, 3] Because glaciation was slight, the area was exposed to prolonged and intense periglaciation. Many of the rocks proved sensitive to frost shattering and readily broke down into angular rubble, which, together with the till of earlier glaciations and the remnants of an old chemically weathered mantle, provided the raw material for abundant solifluction deposits. These now cover most of the country to an average depth of about two feet, thickening to as much as ten feet at the foot of long slopes, but thinning

out on hill tops and steep slopes where bare rock is often exposed. The uniform sheet-type of deposit is overwhelmingly preponderant, but occasional block fields exist; no lobes or terraces have been found.

The nature of the deposits varies according to the rock from which they are derived. On quartzite they consist of a coarse rubble with angular chunks of rock up to a foot long in a scanty sandy matrix. Examples of this kind of deposit are to be found on the slopes of quartzite hills in Aberdeenshire and Banffshire, such as Mormond Hill, The Knock, and The Balloch. Schists, slates, shales and phyllites produced finer-grained deposits with fragments from one to four inches long in a silty matrix. On fresh granite and gneiss there is only a thin layer of coarse rubble since these rocks were little affected by frost shattering. Where, however, they had been previously deeply weathered (probably under warm humid conditions in inter-glacial or pre-glacial times) granite and gneiss broke down under the attack of periglacial frost shattering to furnish entirely different solifluction deposits consisting of grit, sand and clay, often in layers an inch or two thick of alternately coarse and fine material. In some instances these layers have been contorted by the action of frost, at depths well below those attained by freezing under the present climate.

Solifluction probably occurred throughout the last Ice Age in Buchan, uninterrupted by the advent of glaciers. In other parts of the North-East frost shattering and solifluction took place before and after a temporary incursion of the last ice sheet. Many exposures of drift in lower Banffshire reflect this sequence of events: glacial till overlies frost-shattered bedrock and is in its turn overlain by solifluction deposits. When the ice advanced it must have incorporated much of the pre-existing solifluction deposits in its own ground moraine, and, correspondingly, solifluction after the ice retreated was mainly concerned with reworking the glacial till. The effect of solifluction on the relief has been to smooth still further the gently rounded forms which this area inherited from inter-glacial or pre-glacial times.

With the close of the Ice Age active solifluction ceased and peat or soil developed on the stablished surface. There may have been a minor revival of mass movement about 6,000 years ago during the cool, humid Atlantic phase: a peat bed of this age [4] near Huntly is overlain by several feet of earthy rubble which has been stable long enough for a soil profile to have developed upon it.

CENTRAL LOWLANDS, THE MERSE, GALLOWAY

Unlike the North-East these areas suffered prolonged glaciation. The study of melt-water features has shown [5] that the ice lingered long in lowland situations and consequently both the glacial drift and the underlying bedrock were shielded from periglacial conditions until nearly the end of the Ice Age. The solifluction which briefly reworked the glacial deposits in late-glacial times after the ice had gone seems to have been rather ineffective and the main result was to rearrange the upper few feet of the till, imparting a downslope orientation to the stones within it. Only uniform sheets were produced, and no trace of lobes, terraces or block fields has been found. Only a thin layer of

detritus accumulated in the bottom of shallow lakes [6] so solifluction down the adjacent slopes must have been insignificant and the drumlins and kames left by the glaciers were not seriously modified. The solifluction seems to have ceased altogether with the advent of milder post-glacial conditions.

SOUTHERN UPLANDS AND HILLS IN CENTRAL SCOTLAND

Apart from the rugged hills in Galloway most of these areas were not heavily glaciated, were probably freed of ice at a fairly early stage during the glacial retreat, and so were exposed to periglaciation for several millenia before the final termination of the Ice Age. The ice deposited moderate amounts of till, sand and gravel which today are found in the valley bottoms only, while the slopes are covered by a rubble of angular stones in a powdery matrix resting on, and derived from, shattered bedrock. Although this rubble has been mapped as "earthy angular moraine" [7] it is not of glacial origin but is the product of frost-shattering and solifluction under a periglacial climate. Long ago A. Geikie [8] described its main characteristics and realised that it differed from the heavier-textured true glacial till in the valley bottoms. The solifluction deposits are thicker, with more interstitial fine material, on the fissile shaly rocks of the Southern Uplands than on the frost-resistant volcanic rocks of such hills as the Ochils and the Sidlaws.

The onset of solifluction when the ice retreated seems to have first swept any glacial till off the slopes and concentrated it in the valley bottoms. Then solifluction began to transport the angular rubble produced as frost shattering got to work on the bare slopes. Although the period of shattering and solifluction was longer than in the lowlands it was still too brief for deposits comparable in volume to those of the North-East to accumulate. Solifluction deposits form only a thin skin less than a couple of feet thick on the hills, becoming somewhat deeper at the foot of long slopes but not extending far out from the valley sides in the form of a colluvial apron. The deposits are predominantly of the uniform sheet type, but stone-banked lobes exist on the granite summits around Loch Trool. Faint horizontal undulations and linear vegetation patterns on the Moorfoots, Lowther Hills, and Criffel, may correspond to buried remnants of old solifluction terraces. In most cases the rocks were too fissile to produce block fields, although examples did develop on the more resistant granites in Galloway, and in places such as Lee Pen near Peebles where the rocks were locally more coherent.

With the change to milder post-glacial conditions the solifluction deposits coating the slopes were generally stabilised and developed a cover of peat or soil. Nevertheless, limited solifluction does continue today on high ground especially where the vegetation cover has been damaged. Bare patches of rubble, obviously moving down the slopes and sometimes sorted by the action of freezing and thawing into striped patterns are not uncommon. [9] In most cases contemporary solifluction is merely reworking material formed initially by frost-shattering in late-glacial times and re-exposed by the destruction of the peat and vegetation by fire and grazing. Small turf-banked and stone-banked lobes

occur on White Coombe, Lee Pen, The Merrick, and the Kells Range, the Ochils and the Renfrew Heights. These features are generally made of angular stones about six inches long with little interstitial fine material and have "risers" about a foot high. Some contemporary movement of the lobes is indicated by the disturbance of the adjacent turf. Above an altitude of around 1,500-2,000 feet boulders on the surface are generally creeping down slopes steeper than about 10 degrees, and are commonly found with a "bow-wave" of turf and soil pushed up in front of them as they move. All these examples of contemporary solifluction are, however, insignificant compared to the fossil deposits that formed in late-glacial times. An overall impression prevails that solifluction is now relatively quiescent.

THE HIGHLANDS

During the maximum of the last glaciation the whole of the Highlands, apart from insignificant nunataks, was buried under ice and snow which excluded the possibility of solifluction. As the glaciation waned, the surface of the ice sank downwards until it spilt into separate glaciers occupying the valleys, leaving the intervening ridges exposed to a harsh periglacial climate that favoured solifluction. Finally, near the close of the Ice Age, only small glaciers survived in corries with perhaps small snow fields on the highest summits, and practically the entire area experienced periglaciation. Deglacierisation seems to have taken place earlier in the east than in the north and west and consequently periglacial conditions prevailed longer in the former area. Furthermore, the erosive effects of the glaciers in the north and west were so powerful that when the ice did finally melt away it left wide areas of bare rock whose smoothed, hard surface was almost immune to frost shattering and solifluction. This is the case, for example in the areas of Lewisian gneiss. Hill tops were less severly glaciated and were early exposed to periglaciation as the surface of the ice shrank down when glacial retreat set in: consequently in these situations a bouldery rubble is found, known as "mountain-top detritus" and derived from the underlying bedrock by frost shattering. The rubble may even be in part a relic of interglacial or preglacial chemical weathering.[10] It is this mountain-top detritus which has been most affected by the milder periglacial conditions that have prevailed on high ground since the end of the Ice Age.

A wide variety of solifluction phenomena exists in the Highlands. Uniform sheets are characteristically found in two situations: on moderate slopes near the valley floors, and on rolling high-level plateaux. In the former situation the deposits consist of slightly reworked glacial drift, and are now usually immobilised under a layer of peat. In the latter situation the material is mountain-top detritus, the vegetation is scanty and peat absent and the deposits are actively moving under the present climatic regime, although they may well have been even more active under harsher climates in the past.

Stone-banked lobes are common features on moderate to steep slopes. Only the smaller examples are truly active today and the others must

therefore be ascribed to past climatic conditions. Their dimensions seem to be related to the size of the stones comprising the "risers"; giant examples on Lochnagar (Pl. 1) have risers as much as fifteen feet high, composed of granite boulders up to four feet long. On many hills, e.g. Broadcairn near Lochnagar, the stone-banked lobes around the summit are fully exposed but those at lower altitudes are buried in peat. The lobes must have developed in late-glacial or very early postglacial times between 8,000 and 12,000 years ago :— before this period the slopes were still ice-covered and after it came the warm, dry Boreal Period, unfavourable to solifluction, followed by the Atlantic Period when the overlying peat developed and checked any further movement.

Stone-banked terraces are not as common as stone-banked lobes but a few large ones with "risers" ten to fifteen feet high have been encountered on gentle slopes on the White Mounth at about 3,500 feet. These terraces are immobile today and probably formed at the same time as the stone-banked lobes on Broadcairn.

Turf-banked lobes are smaller than the stone-banked variety and occur in detritus containing no large boulders. They tend to form on grassy slopes in damp sites, and the disturbance of the vegetation around them indicates that unlike the stone-banked features they are actively developing today. Turf-banked terraces with "risers" from one to four feet high as a rule, and "treads" from six to twenty feet wide exist on many hillsides and have frequently been described. [11]

Block fields are widely distributed wherever glacial deposits or mountain-top detritus containing boulders occur. At high altitudes, such as the summit plateau of the Cairngorms, these block fields are practically bare of vegetation and the boulders are still creeping down the slopes, but motion was probably more rapid in the past when a severer climate prevailed. At lower levels the block fields are obscured and immobilised by peat and are only occasionally revealed in gullies and cuttings.

The solifluction deposits on Ben Wyvis in eastern Ross and Cromarty are of particular interest since a wide variety of phenomena exists in a small area (Fig. 1). Ben Wyvis is a steep-sided plateau rising to 3,428 feet, built of platy gneiss and indurated schist. When attacked by frost the former rock breaks down into thin flat fragments less than a foot long with abundant fine material, the latter into blocky boulders and slabs with only a little interstitial sand and silt. During the last Ice Age the mountain was not overridden by the ice sheet [12] and consequently the summit and flanks are covered to a depth of several feet with mountain-top detritus which has provided the raw material for the solifluction deposits.

Uniform solifluction sheets cover the undulating summit plateau and are particularly characteristic of areas underlain by the platy fissile gneiss. They also occur on slopes gentler than 10 degrees around the foot of the mountain, buried under peat. At the edge of the plateau where the gradients steepen to over 8 degrees the uniform sheets terminate in a fringe of small stone-banked lobes or a single turf-banked terrace running more or less along the contour for almost half-a-mile. The solifluction sheets are now almost stable and covered by grass and *Rhacomitrium* heath (moss) [13] and seem to have developed at some

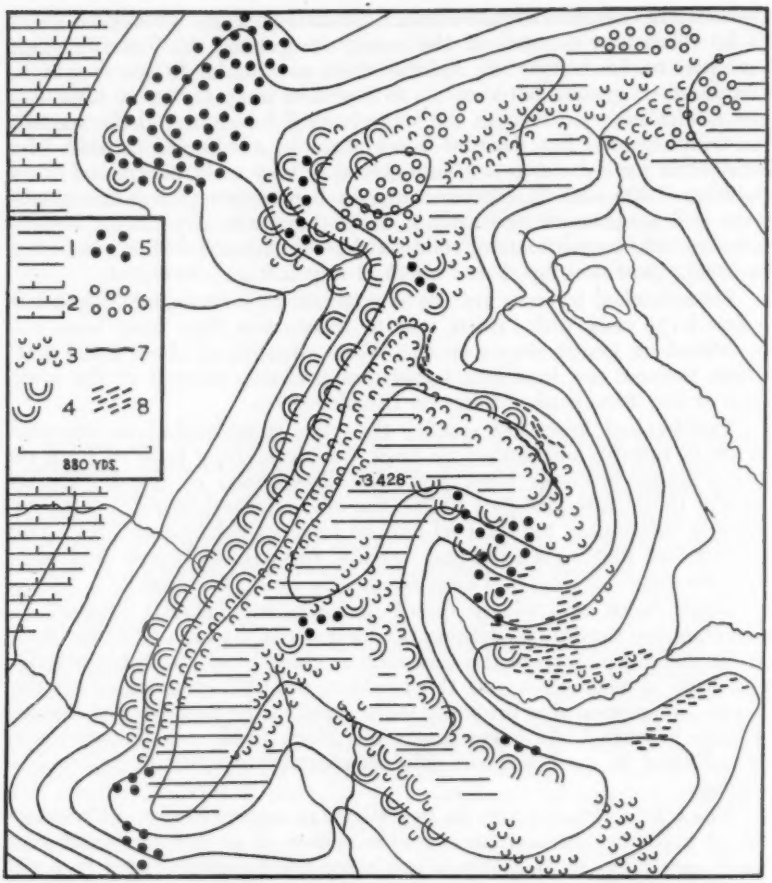


Fig. 1. Solifluction phenomena on Ben Wyvis. 1. uniform solifluction sheets on summit plateau (partially active); 2. uniform solifluction sheets at low levels buried under peat (inactive); 3. turf-banked lobes (active); 4. stone-banked lobes (inactive); 5. block fields and stone streams (mostly inactive); 6. ring and stripe patterns in *Rhacomitrium*; 7. contiuous turf-banked terrace (inactive); 8. discontinuous turf-banked terraces (active).

time in the past when the plant cover was less complete. This implies the existence of a former period of more severe periglaciation for which additional evidence is provided by patterned ground at the northern end of the summit plateau.

On a few acres of level ground the *Rhacomitrium* heath occurs in a pattern of shallow circular hollows forming rings of fresh green moss 5-10 feet in diameter surrounding a slightly higher central dome of withered brown moss. On slopes, the rings become elongated into ovals which pass into parallel stripes when the gradient exceeds 6 degrees. Excavation shows that the vegetation patterns correspond to an arrangement of the underlying rock detritus. Below the channels large stones

lie with their long axis pointing down the slope, while under the intervening areas the ground surface is slightly higher and consists of small stones, sand and silt. The greenness of the moss in the channels is undoubtedly a result of the concentration of soil water in the hollows below. Comparison with actively developing stone stripes and polygons in Greenland (Fig. 2) suggests that the Ben Wyvis patterns were once similar and were subsequently colonised by vegetation after they had been stabilised by a climatic amelioration. The processes by which the patterns formed initially are a matter of controversy [14] but certainly frost played an important part, while the elongation of the patterns on slopes has been due to solifluction. It is not possible to fix the time when the patterned ground was last actively forming, nor to define closely the climatic conditions which then prevailed, but the fact that the patterns are three to five times larger than those currently developing suggests they are a relic of a former much harsher climate.

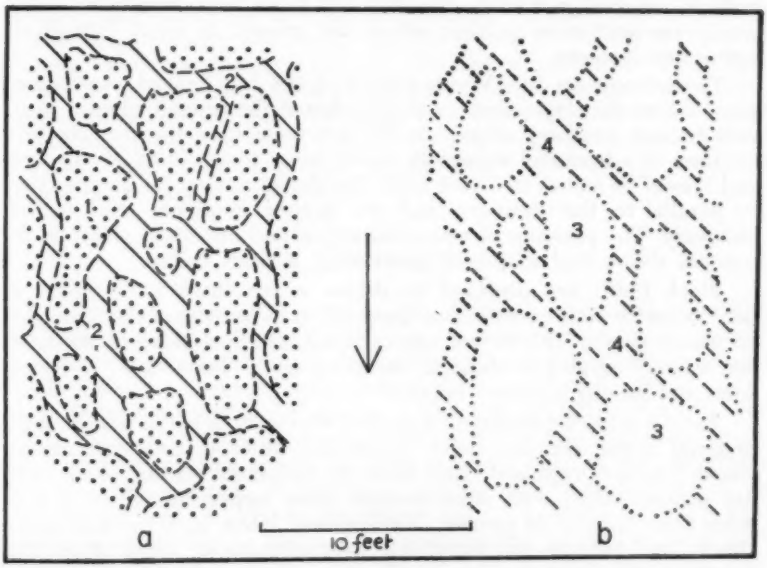


Fig. 2. Patterned ground (a) in Greenland (b) on Ben Wyvis. Arrow shows direction of slope. 1. bare ground with few stones; 2. rim of large, platy stones; 3. low mounds of grey-brown *Rhacomitrium* moss growing in almost stone-free ground; 4. shallow hollows of green *Rhacomitrium* moss underlain by platy angular stones.

Stone-banked lobes occur on slopes from 8 to 20 degrees. They have a considerable range of size with "risers" from 2 to 10 feet high and 12 to 100 feet wide. There is often a downslope sequence from small, regular lobes, lying side by side and forming an irregular terrace, to larger lobes more haphazardly disposed. Stone-banked lobes occur only on blocky material derived from the indurated schists and are absent on slopes underlain by platy gneiss. Like the patterned ground and the uniform solifluction sheets they must be ascribed to more severe periglacial conditions in the past. On gradients less than about 15 degrees

the lobes are stabilised and the chief contemporary geomorphic process affecting them is the washing out of interstitial fine material and its deposition as an apron on the gentle slopes below. Even on slopes steeper than 15 degrees the lobes are stabilised as a whole, but individual boulders have continued to creep independently down the slope, leading to a gradual destruction of the lobes and their transformation into block streams and block fields.

Turf-banked lobes on Ben Wyvis are smaller than the stone-banked variety, have a less distinct form, and tend to be located on rather gentler slopes between 5 and 12 degrees. Disruption of the vegetation around them indicates that they are actively moving under the present climatic regime, but no estimate can be made of the rate of movement. They are found only where suitable material occurs, with a considerable proportion of fine matter and few boulders. Accordingly they are associated with the platy, easily weathered gneiss, the aprons of fine material washed out from stone-banked lobes, and situations below semi-permanent snow patches where the ground is moist throughout spring and summer.

The terraces on Ben Wyvis are all of the turf-banked variety and occur where the slope steepens at the edge of the summit plateau or on well-drained heathery slopes. In the latter situation the terraces take the form of subparallel steps with nearly bare "treads" 2 to 20 feet wide and "risers" 6 inches to 3 feet high. On slopes around 10 degrees they lie parallel to the contours, but on steeper gradients tend to run obliquely. The presence of up-ended stones and disrupted plants in the terraces shows that motion is proceeding actively today.

Block fields are confined to slopes where there is a supply of boulders with no interstitial fine material, or as individual blocks resting on grassy slopes. The former appear immobile, but many of the latter are actively moving downslope, thrusting up a "bow-wave" of turf in front and leaving a furrow behind.

Factors affecting solifluction on Ben Wyvis include the nature of the material, water content, slope, vegetation, altitude, and exposure. In coarse bouldery rubble derived from the indurated schists, block fields are characteristic, with stone-banked lobes appearing where a little more fine material is present. Turf-banked lobes, uniform solifluction sheets, and terraces are associated with mixtures of small stones and fine material. Contemporary solifluction affects only material with a high proportion of fine matter: it is true that individual boulders are still creeping down slopes but they can only do so over a substratum rich in fine matter. Contemporary movement is generally most active in damp hollows and below snow patches, showing that abundant soil water assists solifluction. However, the turf-banked terraces on heathery areas are an unexplained exception since they are certainly actively moving but occupy dry sites; their oblique trend relative to the direction of slope is also a puzzling feature. Heather with its long roots helps to maintain the steep fronts of turf-banked terraces while the *Rhacomitrium* heath, on the other hand, is shallow-rooted and appears to play little part in restricting solifluction. Gentle slopes favour uniform solifluction sheets; moderate slopes are associated with turf-banked lobes and terraces, and block fields. Steep slopes go with large stone-banked

lobes, now immobile, and the contemporary movement of individual boulders. The effects of altitude are largely masked by other factors: solifluction is certainly most active above 2,000 feet but this is chiefly because the slopes steepen and the heather and peat are replaced by *Rhacomitrium* heath at about this level, and only a proportion of the increased activity can be directly ascribed to the deterioration of climate with altitude. Snow patches lie longer on north-facing than on south-facing slopes and consequently there is a tendency for contemporary solifluction to be more active on the former. No such effect of exposure could be found in the case of the fossil solifluction phenomena.

The various solifluction phenomena on Ben Wyvis have developed at different times. The stone-banked lobes, block fields, and uniform solifluction sheets are almost immobile today and probably were most active in late-glacial times when the permanent snow fields of the Ice Age had gone, but the climate was still severe and the vegetation sparse. With the change to milder post-glacial conditions, these types of solifluction stagnated, but turf-banked lobes and terraces, and individual block-creep became dominant, and today are modifying the earlier forms. These conclusions hold good for the whole of the Highlands, although uniform solifluction sheets at high levels are generally rather more active than on Ben Wyvis. In the Highlands, unlike the rest of Scotland, post-glacial solifluction has not been insignificant compared to that which occurred in late glacial times, although it has been restricted to smaller phenomena.

THE ISLANDS

Only brief visits were made to the Shetlands, Orkneys, and Outer Hebrides, and the Inner Hebrides were not examined, but enough information was gathered to demonstrate that solifluction phenomena with distinctive characteristics occur in each group of islands.

Conditions in Shetland below 1,200 feet resemble those in the Southern Uplands. The commonest deposit is a rubble of angular stones in a powdery matrix, resting on frost-shattered bedrock and forming a smooth layer a couple of feet deep that can thicken to as much as six feet at the foot of long slopes. The rubble is now stabilised by peat and it is reasonable to assign it to periglaciation during the latter part of the Ice Age when the ice had left the area. Solifluction at that time seems to have stripped glacial till from the slopes and concentrated it in the valley bottoms. At higher altitudes the solifluction deposits of Shetland resemble those of the Highlands: the block fields and partially developed stone-banked terraces found at 1,200-1,400 feet around the summit of Ronas Hill are like those found at 3,500-4,000 feet on the Cairngorms. Doubtless these features were initiated under more severe conditions in the past but they continue to evolve under the contemporary climate thanks to the scanty vegetation. Small stone stripes on bare rubble on the island of Unst [15] indicate that mass movement under "periglacial" conditions can still take place today even at sea level if the vegetation is restricted.

In the Orkneys, surprisingly few signs of solifluction were noted on Mainland, but were frequently encountered on Hoy. A particularly

striking example near Rackwick consisted of coarse sandstone rubble about thirty feet thick at the foot of a long slope with a gradient of about 20 degrees. All the deposits on Hoy were capped by soil or peat and must be assigned to periglacial action in late-glacial times. Angular rubble preserved under glacial till [16] indicates that conditions favourable to frost-shattering and solifluction existed before the advent of the ice as well as after its disappearance.

On low ground in the Outer Hebrides intense glacial erosion swept away all loose material and left wide areas of bare rock immune to frost-shattering and totally unsuited to the development of solifluction deposits. The hills of Harris were less intensively glaciated than the lower areas and probably formed nunataks exposed to intense frost-shattering for much of the last glaciation. Consequently, block-fields developed, which are now partially stabilised by heather and peat. St Kilda was untouched by glaciers from the mainland but carried a small ice cap of its own, beyond whose limits solifluction deposits accumulated. [17] From photographs it is apparent that both fossil and contemporary deposits, including uniform sheets, lobes and terraces, exist on the island.

Photographs suggest that solifluction deposits are not extensively developed in the Inner Hebrides, although small-scale mass movement is active today on high ground. [18] However, these islands were not examined in the course of the present study and solifluction phenomena may be more widespread than appears at present.

There have been at least three distinct phases of periglaciation and solifluction in Scotland. Phase one, of unknown duration and intensity, occurred at the beginning of the last Ice Age when the climate was already cold but the ice had not had sufficient time to extend far from the initial gathering grounds in the hills. There is evidence for this early period of solifluction in frost-shattered rock and angular rubble preserved below the till in places as far apart as Orkney [19], Banffshire [20], and Midlothian [21]. In most places the advancing ice must have swept up the rubble and incorporated it in its ground moraine.

Phase two occurred after the glacial maximum as the ice diminished and exposed the surface of the land to the harsh climate that still prevailed. The shrinkage of the ice sheet took place first in the North-East and in the eastern half of the Southern Uplands and consequently phase two lasted longer in these regions and they have more solifluction deposits than the rest of the country. The ice probably never reached Buchan and here phase two succeeded phase one without a break. Phase two produced uniform solifluction sheets where the available material was devoid of boulders, and large stone-banked lobes or terraces and block fields in areas of hard rock where plenty of large stones existed. The stone-banked lobes, terraces and block fields are found only on high ground although there is strong evidence [22] for the existence of severe periglacial conditions in lowland areas at that time. The absence of stone-banked features from lowland sites where rock and slope conditions seem suitable presents an unsolved problem.

It should be mentioned that there is evidence of an important

interstadial period during the course of the last glaciation between phases one and two when much of the country was ice-free and subject to periglacial action : however, not enough is known about it to warrant further consideration here. Probably many more periglacial phases with solifluction occurred during middle and early Pleistocene times, but of these we have no record.

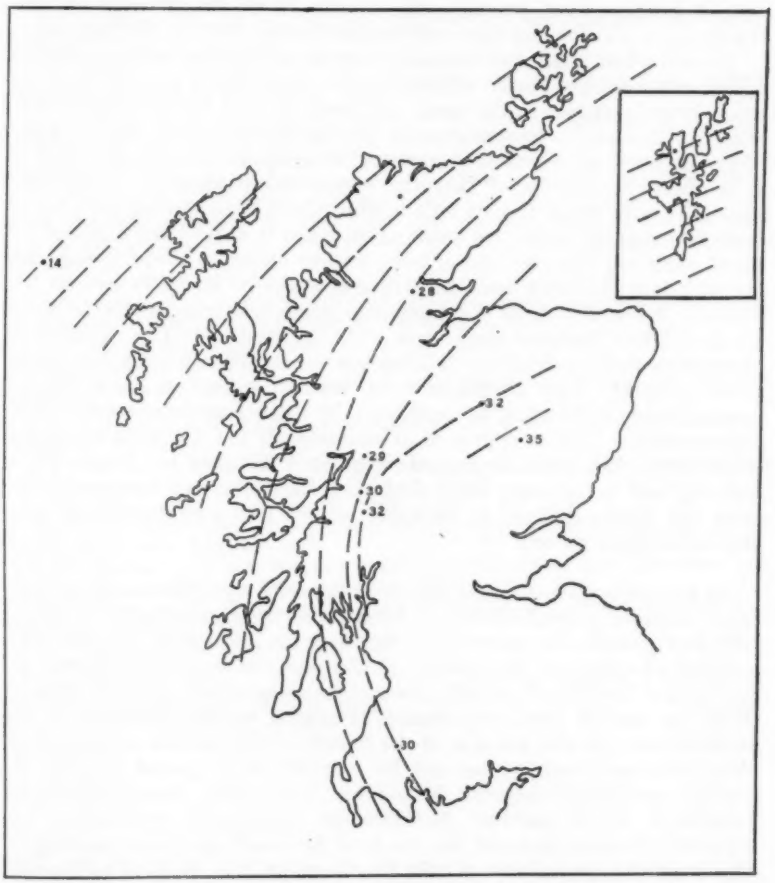


Fig. 3. Altitudes on granite hills, in hundreds of feet, above which vegetation covers less than half the surface. The value for south-west Scotland is estimated. The contours correspond to the generalised lower limit of very active contemporary solifluction. Shetland inset. The three spot heights without numbers are : Lewis (20); Sutherland (23); Shetland (12).

Some inferences concerning the climatic factors influencing solifluction during phases two and three can be drawn. Large stone-banked lobes and terraces, characteristic of phase two, occur above 1,800-2,000 feet in all parts of the country (and in North-West Ireland) and the controlling climatic element or elements must have been of the same

intensity everywhere. It is known that both precipitation and winds were markedly greater in the west than in the east during phase two [23] so it is unlikely that these were the climatic elements primarily responsible for solifluction at that time. Hence it appears that temperature was the decisive element and must have been more or less uniform at the 2,000 feet level throughout the northern part of the British Isles, at least during spring, summer and autumn. In winter probably all solifluction was checked by the continuously frozen state of the ground.

On the other hand, turf-banked terraces and patches of bare ground which are associated with solifluction in phase three extend down to much lower altitudes in the north and west than in the south and east. (Fig. 3). Contrasts in temperature or precipitation between the two parts of the country seem totally inadequate to account for this distribution. It is therefore concluded that the significant element in postglacial times has been wind. High winds inhibit plants thus leaving the ground bare and readily subject to solifluction since it is no longer bound by plant roots nor insulated from temperature changes. Wind speeds are far higher in the west and north than elsewhere: at 1,400 feet on the summit of Ronas Hill in the Shetlands winds are comparable to those on top of Ben Nevis at three times this altitude. [24] The density of vegetation and the intensity of contemporary solifluction are similar on both summits. The significance of scanty vegetation in favouring contemporary solifluction is emphasised by the occurrence of active mass movement and patterned ground at anomalously low altitudes where the plant cover has been destroyed: e.g. at 1,300 feet on Tinto where burning and overgrazing have destroyed the grass and heather [25] and near sea level on Unst in Shetland where bad soil conditions have restricted plant growth. [26]

It has been shown that solifluction deposits are widespread in Scotland, occur in a great variety of forms, and have developed at several different periods. In many areas the deposits represent no more than a slight reworking of pre-existing glacial material but in the North-East and on the Southern Uplands they comprise the dominant drift deposit. They are not of great importance in regard to the evolution of the landforms as a whole because of the brevity of the periods during which they developed and it must not be forgotten that glacial deposits far exceed periglacial deposits in volume, and often create significant landforms in themselves. Nevertheless periglacial solifluction has provided the raw material for much of Scotland's soil and pedological studies must take account of this. Furthermore, the study of solifluction can not only throw additional light on the history of the country in the Pleistocene but can also lead to a better understanding of the contemporary climate, soils, and vegetation on Scottish hills. Such a better understanding is an essential step towards improved utilisation of the country's empty spaces.

[1] Fitzpatrick, E. A. An introduction to the Periglacial Geomorphology of Scotland. *S.G.M.*, 1958, 74 (1): 28-36. This paper is recommended as an introduction to the present contribution. The latter is based on field work, 1952-58 (supplemented by study of air photos on a scale of 1 : 10,000) details of which are contained in

the author's Ph. D. Thesis *A study of periglacial phenomena in Scotland*, M.S., Edinburgh University, 1958.

[2] Charlesworth, J. K. The Late-Glacial History of the Highlands and Islands of Scotland. *Trans. roy Soc. Edin.*, 1956, 62 (19) : 769-928.

[3] Synge, F. M. The Glaciation of North-East Scotland. *S.G.M.*, 1958, 72 (3) : 129-143.

[4] Durno, S. E. Private Communication.

[5] Sissons, J. B. The Deglaciation of Part of East Lothian. *Trans. Inst. Brit. Geogr.*, 1958, No. 25 : 59-77.

[6] Donner, J. J. The Geology and Vegetation of Late-Glacial Retreat Stages in Scotland. *Trans. roy. Soc. Edin.*, 1957, 63 (11) : 221-264.

[7] e.g. One-inch map, *Geological Survey Scotland*, Sheet 24, Peebles.

[8] Geikie, A. The Geology of East Berwickshire. *Mem. Geol. Surv. Scotland.* Explanation of Sheet 34. 1st Ed., 1863.

[9] Miller, R., Common, R., Galloway, R. W. Stone Stripes and other Surface Features of Tinto Hill. *Geogr. J.*, 1954, 120 : 216-219.

[10] Dahl, E. Biogeographic and Geologic Indicators of Unglaciated Areas in Scandinavia during the Glacial Ages. *Bull. Geol. Soc. Am.*, 1955, 66 : 1499-1519.

[11] Peach, B. N., *et al.* The Geology of Ben Wyvis, Cairn Chuinneagh, Inchbae, and the surrounding country. *Mem. Geol. Surv. Scotland.* Expln. of Sheet 93, 1912.

[12] Hinxman, L. W. in *Summary of Progress for 1903.* Geological Survey of Scotland, 1904.

[13] Pearsall, W. H. *Mountains and Moorlands.* London, 1950.

[14] Washburn, A. L. Classification of patterned ground and review of suggested origins. *Bull. Geol. Soc. Am.*, 1956, 67 : 823-865.

[15] Spence, D. N. H. Studies on the vegetation of Shetland. I The serpentine debris vegetation in Unst. *Journ. Ecol.* 1957, 45 : 917-945.

[16] Wilson, G. V., *et. al.* The Geology of the Orkneys. *Mem. Geol. Surv. Scotland*, 1935.

[17] Wager, L. R. The extent of glaciation in the Island of St Kilda. *Geol. Mag.*, 1953, 90 : 177-181.

[18] Godard, A. Quelques observations sur le modelé des regions volcaniques du nord-ouest de l'Ecosse. *S.G.M.*, 1958, 74 (1) : 37-43.

[19] Wilson, G. V. *et al. Op. cit.*, 1935.

[20] Read, H. H. The Geology of the Country round Banff, Huntly, and Turriff. *Mem. Geol. Surv. Scotland*, 1923.

[21] Shattered rock is so frequent in the Central Lowlands that quarrymen have coined the term "tirrings" for it.

[22] Galloway, R. W. Ice wedges and involutions in Scotland. *Biuletyn Peryglacjalny*, 1961, No. 10.

[23] Charlesworth, J. K. *Op. cit.*, 1956.

[24] Spence D. N. H. *Op cit.*, 1957.

[25] Miller, R., Common, R., Galloway, R. W. *Op. cit.*, 1954.

[26] Spence, D. H. N. *Op. cit.*, 1957.

FOSSIL ICE-WEDGE AT POLTALLOCH

In a recently opened gravel working at Poltalloch, on the west side of the Kilmartin valley, Mid Argyll, there has appeared a fossil ice-wedge (Fig. 1). Its presence was reported to the writer by Mr E. R. Cregeen who was directing the excavation of a prehistoric burial/cremation site which overlies the wedge.

The feature is developed in current-bedded gravels of varying size on the top of what is described on the 1 : 63,360 Drift Geology Sheet, No. 36, *Kilmartin*, as the "second raised beach". The top of the wedge lies at approximately 130 feet above O.D. (National Grid Reference : NR/821972). The section bearing the ice-wedge consists of a turf and grass layer on a slightly leached soil, grey in colour. Underneath is a series of sorted, bedded gravels to a depth of three and a half feet below which the coarser gravels disappear and there is an increasing admixture of coarse sand. At the bottom of the section this coarse sand becomes exclusive. Loose tumbled gravel had to be cleared away from the foot of the section to observe the bottom of the wedge.

The vertical depth of the wedge appears to be seven feet, but the axial depth is half a foot more, the wedge being cut slantwise into the gravels. At the top it is almost four feet wide and narrows rapidly to thirteen inches two feet down, thereafter maintaining a fairly constant width of five to six inches from three to six feet down. It then tapers to a band of red (iron ?) staining about half an inch wide in the undisturbed coarse sand at the bottom of the section. Throughout its length the wedge maintains a colour contrasting with the grey-brown of the gravels and grey of the sands. In the top two and a half feet it is a light yellow colour where there is a high proportion of very fine material (fine sand and silt), this being replaced by a deep yellow-brown staining in the gravels of the lower part of the wedge material.

There has been considerable distortion of the bedding of the gravels during the cutting of the wedge. This is at once evident from the down-bending of the bands of coarser gravel, but is seen also in the progressively steeper angle adopted by the long axes of all particles close to the limits of the wedge.

The infill of the wedge consists of parent gravels in the lower part clearly pulled into the wedge cavity, the axes of all of the particles being almost vertical. In the upper part the presence of very fine material contrasts markedly with its apparent absence in the surrounding gravels. Presumably this fine material was derived from the original surface into which the wedge was cut. Throughout the wedge-material are found occasional very badly shattered stones. The wedge tends to be slightly indurated probably due to illuviated iron-compounds derived from the leached soil, and thus stands out in relief in the section. This could also account for the contrasting colour.

In the same section in this gravel-working there is a second feature which might be another ice-wedge, but trough-shaped, being about twenty-two inches deep and ten inches wide. Axial re-orientation of the individual particles in the infill of this feature is not apparent. The infilled material appears randomly mixed; it is necessary to remember here the presence of an archaeological site above. There are other minor signs of disturbance in the neighbourhood of the wedge, mainly slight distortion of the bedding in the top of the gravels.

In another part of the same workings, again in the current-bedded gravels, are developed sharp discontinuities, in one case involving a vertical displacement of three inches. These discontinuities are marked by about two inches in width of unsorted fine gravel and sand. The width is consistent throughout depths of more than ten feet and the discontinuities are present at angles of up to thirty degrees from the vertical. In one case two of these features intersect. There is a colour and induration contrast with the surrounding gravels. These features may be associated with the periglacial conditions which produced the now fossilised ice-wedge.

The gravel is being worked for use in a local Hydro-electric scheme and when the archeaological site has been excavated, the gravels bearing the ice-wedge will be removed

R. A. Gailey.

Plate 1

Large stone-banked lobes with fronts up to 15 feet high situated on the southern slopes of Cuidhe Crom, Lochnagar area, Aberdeenshire, between 3,000 and 3,500 feet above sea level.

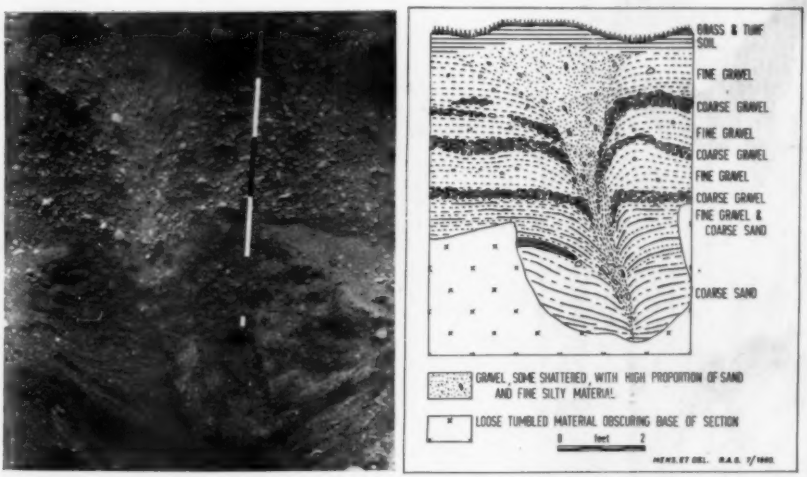


Plate 2

Fossil ice wedge at Poltalloch, Kilmartin valley, Mid Argyll.

Part of Reid's Plan of the Island of North Uist, 1799.

The whole plan is at a scale of about 15 Scots chains to one inch (c.3½ ins. to one statute mile) and measures almost six feet square. It is oriented so that left and right hand margins lie almost NE-SW. Relief features shown by a grey wash, darkness of tone indicating steepness of slope; coast emphasised by parallel lines and picked out in green wash; fresh-water lochs similarly outlined in blue; un-

Pla

cultivated land has a conventional symbol and grey wash; land liable to sand-drift a yellow wash with grey shading. The plan shows regular boundaries of townships and lots of crofts (serially numbered) over original irregular boundaries (see Fig. 1) of townships and common arable held in run-rig (indicated by faint parallel lines). Extensive areas in Balranald and Kyles Paible (25 and 4) tinted to show "ground liable to sand-drift".

John Mackay

Plate

Herd of Ayrshire cows on fresh pasture (ley) in Central Ayrshire. Here on gently undulating boulder clay country (c.300 feet) rotation grass is the most important crop; it provides a hay crop on which winter milk supply depends. Ayrshire cows are considered the most 'stylish' of all dairy breeds. The horns, which for generations were specially trained as a 'show' point, are now the exception and 'polling' is becoming more usual.

NORTH UIST IN 1799

H. A. Moisley

"The past is the key to the present" no less in the cultural than in the natural landscape. Studies in the human geography of the Outer Hebrides have, until now, been hampered by the lack of large-scale detailed plans and surveys relating to the period which terminated when the ancient run-rig fields were first lotted and the associated clachans gave way to a generally more dispersed form of settlement. Roy's map, a valuable source for mainland districts, does not extend to the Outer Isles. Existing records, known to the writer, are limited to a small-scale lithographed plan of South Uist and Benbecula (William Bald, 1806) and some fragmentary sketches, probably of lotting proposals, of individual Lewis townships, dated 1850 or 1851. Other surveys were almost certainly made; Bald's map, in particular, appears to have been reduced from a larger-scale plan, but the ravages of time and fire have done their work and such surveys, if still surviving, are probably languishing unrecognised in some lawyer's or factor's store.

Such was the fate of Robert Reid's *Plan of the Island of North Uist belonging to Alexander Lord Macdonald,* dated 1799, recently discovered in an Edinburgh basement. As an example of the eighteenth-century surveyor's art, the plan is outstanding neither in execution, nor in preservation; like Roy's map, the style of which it resembles, it is a fine sketch rather than an accurate survey. (See Plate 3). When found it was mounted on linen, on a wooden roller, but the outer layers of the map had rotted so that a strip along the northern margin is badly discoloured and small pieces are missing. The remainder is in a fair state of preservation, except that some of the colours are badly faded. All the islands of the parish are included, from Boreray in the north to Grimsay in the south; the "Islands of Heisker lying about eight miles west of the point of Hougharry" are placed in an inset. The irregularities of the coastline of the main island are shown quite accurately, although, again like Roy's map, direction is sometimes distorted. [1] Inland, many of the fresh-water lochs are either grossly inaccurate or missing. Heisker is most crudely portrayed, so much so that one suspects that the cartographer visited it briefly if at all. It appears that he concentrated on the main island, and in particular on the coast, probably relying on compass traverses, and resorted to hasty field-sketching for such detail as is shown for the interior. This would indeed be a justifiable procedure in the circumstances, for the main purpose of the work appears to have been a survey of the arable lands and associated pastures and these, together with the main settlements, were almost entirely along the west coast.

When compared with a present-day map the plan provides striking confirmation of local tradition as to coast erosion and sand drift on the west coast; it is a valuable addition to such published evidence as exists. [2] The most obvious changes have taken place in the Kyles Paible, Balranald and Hougharry areas. Kyles Paible, in particular, appears to have been severely reduced (compare Fig. 1A and B with Fig. 1C); in

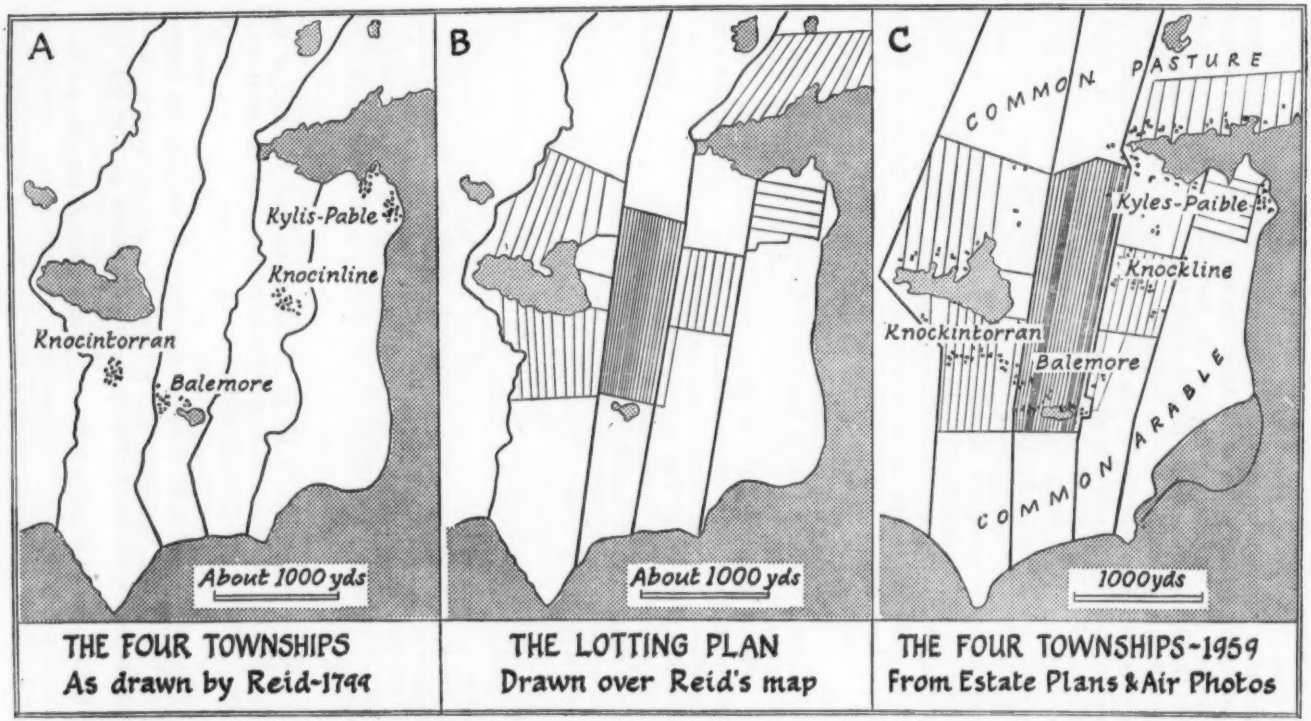
this connection it is worth remarking that the former township of Husabost, known to have existed in the fifteenth century but now represented by an off-shore reef, lies between Kyles Paible and Kirkibost.

In 1799 the run-rig system still prevailed through North Uist, although several extensive areas were in the hands of tacksmen. The houses of the small tenants and sub-tenants are a prominent feature of the map "crowded and huddled together in a manner most unfriendly to cleanliness" as, in retrospect, the writer of the *New Statistical Account* described them. [3] The map shows that, here at any rate, the granting of tacks or leases in the late-eighteenth century did not necessarily lead to the disappearance of the clachans. Tigharry, Baleloch and Hosta, for example, each had a clachan although all are known to have been the subjects of leases. The great farm of Balranald too, had its clachan, close to the present Balranald House; the Balranald farm house of 1799, however, is shown on a hill further inland, thus confirming local tradition, which also has it that this was a long thatched house. At this point, in the nineteenth century, stood a sort of clachan of farm servants and tradesmen, presumably a survival from the domestic settlement shown on Reid's map.

The most detailed work on the map is the depiction of arable land which was clearly the main object of the survey. Every "parcel" is serially numbered. Unfortunately the book or table of reference is not attached to the map, nor has it yet come to light, despite extensive enquiries. The arable land is indicated by parallel lines, each of the main blocks being separated by transverse lines. Soil type is indicated by colours, now unfortunately badly faded: "Sandy arable"—yellow; "Mixed sand and moss"—pink; "Mossy arable"—grey.

The pH value of the "sandy arable" areas is today almost invariably more than 8.0, and that of the "mossy arable" generally less than 6.0. Thus, without the aid of modern soil science, Reid produced a remarkably accurate classification of the soils of North Uist. Without exception the clachans are sited on the sandy land, an interesting commentary on the influence of machair land on the choice of early settlement sites here as elsewhere in the Hebrides.

In most of the townships the pattern of run-rig fields has superimposed upon it, in red ink and apparently by a later hand, plans of lotted crofts. The lotting of North Uist took place in 1814 [4]; later some townships were cleared to make large farms. In those which were not subsequently cleared the present lay-out corresponds closely to that drawn over Reid's plan, (compare B and C in Fig. 1). There are a few discrepancies: lots are shown, for example, on Balelone and Baleloch which were probably never lotted, being cleared for farms in 1815. On the other hand in one or two cases lots are not shown although the townships are believed to have been lotted in 1814. Tigharry provides an example. This farm was leased to the minister, the Rev. Allan MacQueen, which probably explains why it was excluded from the plan for lotting crofts. However MacQueen died in 1801 and, whilst it is not known whether or not his immediate successor took over the tack, by 1818 the minister, the Rev. Finlay McCrone, was farming Baleloch; meanwhile in Tigharry crofts had been lotted to small tenants. Thus it appears that what we have is a lotting plan—the proposals before



The Paible district of North Uist (see Pl. 3). In C the common arable machair, until recently held in run-rig, has been lotted in Kyles Paible and Knockline. The land lost by coast erosion since 1799 is indicated.

abolition of run-rig rather than a subsequent survey of what had actually been done.

The plan shows other aspects of the re-organisation of agriculture and settlement taking place at the time. On the ground today one may still discern the meandering lines of old turf-dykes, corresponding to the old boundaries mapped by Reid in 1799, but the modern boundaries nearly always correspond to the regularised lines drawn over Reid's plan (compare A and B, Fig 1). The re-distribution of population, and its spread from the machair lands to some of the moss land, is clearly shown. In 1799, Reid found no settlements along the south-west coast between Kyles Paible and Carinish, but the lotting proposals show more than thirty new crofts along this shore. Here the new townships of Claddach Kyles, Claddach Kirkibost, and Claddach Illeray were formed, probably to relieve congestion in their old namesakes on the off-shore islands. In addition, on the same mossy shore, ten new crofts were formed as an extension of Knockline, (Fig. 1, B). In the north, too, new crofts are shown at Timisgarry, Ahmore and Grenitote, where none had been before.

The writer has endeavoured, so far without success, to trace the book of reference to Reid's map, or contemporary rentals; the latter are known to have existed in North Uist as recently as the nineteen-thirties. Should either be found, then the value of the map will be greatly enhanced. Even without them we have a vivid visual impression, not only of the pattern of population and clachan settlements prevailing under the run-rig system, but also of the early-nineteenth century planned landscape which replaced it. This is a particularly valuable record because, although much of this landscape survives, much was soon to suffer a further change: by the middle of the nineteenth century several large townships in the north had been cleared, their small tenants turned out to make large farms. Most of these, in their turn, have been displaced by more recent re-settlement schemes.

The crofting landscape which we inherit today has passed through many phases. Reid's plan was drawn at a period when the Hebridean proprietors, flush with the proceeds of the kelp boom, were turning to agricultural improvement. The lotting of crofts was the Hebridean equivalent of abolition of run-rig by enclosure on the mainland. The plan, with its over-drawing of regularised township and croft boundaries, provides a remarkable snapshot of the birth of the modern crofting landscape.

The writer is grateful to Dr C. T. MacInnes and his staff at the Scottish Record Office for their co-operation in making the map available for inspection and photography.

[1] O'Dell, A. C., A view of Scotland in the Middle of the Eighteenth Century. *S.G.M.*, 1953, 69, p.59.

[2] See, for example, MacCrury, Rev. E. *A Hebridean Parish*, 1950, pp. 15-17, and McCrae, Rev. F. The Parish of North Uist, *New Statistical Account*, XIX, 1845, p.163.

[3] McCrae, Rev. F. *Op. Cit.*, p.164. [4] McCrae, Rev. F. *Op. Cit.*, p.174.

MILK SURPLUSES IN SCOTLAND

J. D. W. McQueen

A great deal has been written recently about overproduction of milk in Britain and at the last February Price Review the Government formally asked the Milk Marketing Boards to adopt measures to curtail production. An individual quota system has been suggested and though opposition among farmers seems sufficient to make such extreme measures politically impossible it is unlikely that the present increases in production will be allowed to continue indefinitely. Briefly the problem lies in the fact that within the dairy industry there are two separate and very different markets. On the one hand there is the liquid market which is by its nature immune from foreign competition and where the price is determined annually by the Government. On the other hand there is the manufacturing market which is open to foreign competition and where in consequence very low, fluctuating prices prevail. The prices which the Boards receive from the manufacturers vary with the products involved. Milk sold for condensing, for example, normally commands the highest price and for butter-making the lowest. Most important, all these manufacturing prices are usually less than the average cost of production of the milk (the average price of milk sold for butter-making in 1958 was tenpence a gallon) so that every gallon of milk sold for manufacture makes a loss which is offset, via the Milk Marketing Boards' pooling arrangements, by the higher price of liquid milk. Clearly the greater the surplus milk sold to manufacture the lower will be the pool price paid to the individual farmer. In Scotland milk which is surplus to liquid requirements amounts to about 44 per cent of the total production (Fig. 1), a figure which compares unfavourably with the English figure of about 25 per cent. It is the purpose of this article to examine how this apparently absurd situation came about and how it is manifest in the present geography of milk in Scotland.

Until the present century the Scottish dairy industry was principally a farm cheese-economy with liquid milk production confined very much to the immediate vicinity of towns. This is a fact which is not always appreciated though it has been immensely important in shaping the present pattern of milk production in Scotland. It is clear, for example, that without this foundation of farm manufacture the Ayrshire cow would never have ousted the Galloway beef cattle from their native pastures in the south-west. Even to-day the City of Glasgow in summer can obtain all its liquid milk supplies from within a narrow twenty-mile radius, and only occasionally in winter are the milk supplies of the Galloway lowlands tapped for the Clyde Valley market. These milk supplies of the south-west represent, in fact, the legacy of a farm cheese-system which is to-day practised on little more than two dozen Scottish farms. As such these supplies are largely surplus to liquid requirements and must be sold for manufacture.

The Scottish farm cheese-industry effectively dates from the late-seventeenth century when a new system of making cheese from the whole milk was introduced into Dunlop parish in north Ayrshire,

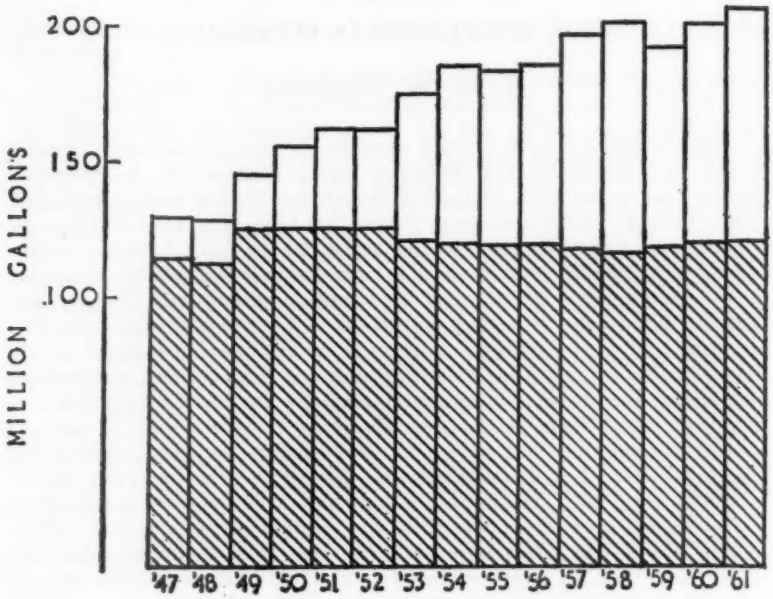


Fig. 1. Total production and liquid sales in the Scottish Milk Marketing Board Area 1947-1961. The shaded part represents liquid sales. Figures in each case are for year ending March 31st.

apparently from Ireland. [1] Stimulated by the subsequent growth of the Clyde Valley market the system spread rapidly through the whole of north Ayrshire and the adjacent parts of Renfrewshire and Lanarkshire, and by the eighteen-thirties the farm manufacture of Dunlop cheese had penetrated as far south as the northern parts of the Rhinns of Galloway. In the eighteen-fifties this was replaced on most Scottish farms by the Cheddar system from Somerset [2], but the expansion continued and in its hey-day towards the end of the nineteenth century farm cheese-making was to be found in all the lowland parts of Galloway, in upper Nithsdale in Dumfriesshire and across the Firth of Clyde in the better parts of Kintyre. It was also found in parts of Dunbartonshire and Stirlingshire. Outside this south-west region the only other parts of Scotland where commercial farm cheese-production was practised was in the extreme north-east and in Orkney in particular. Unfortunately records for these parts are sparse, but on the national scale the farm cheese-production there was of very minor importance.

It would not be reasonable to put a date to the start of the long decline in the Scottish farm cheese-industry but by the eighteen-eighties American and Canadian cheeses were competing very favourable with the home varieties in the Glasgow market. [3] Competition increased annually and more and more producers were induced to seek an outlet for their milk in the liquid market wherever possible. This unstable situation finally collapsed into the financial vortex of the early nineteen-thirties when farmers in Wigtownshire sought markets as far away as

London and were prepared to accept fourpence a gallon for their milk rather than manufacture cheese on the farm. It was then that the Milk Marketing Boards were created to restore order to the industry.

This has been achieved by a careful separation of the liquid and manufacturing markets and by pooling the return from these so that every producer receives the same basic price irrespective of the market in which his own production is sold. No farmer, unless he is also a retailer, has any say in where his milk is delivered and no distributor has any say in where his milk is produced. This has allowed the development of a carefully integrated transport system free from uneconomic overlapping. Milk collected from the farms is directed by the Boards first of all into the high-price liquid market and milk surplus to requirements there is directed into the manufacturing creameries of which there are thirty-three in Scotland (Fig. 2). Of these fourteen are owned by the Boards themselves; the rest are private concerns purchasing milk from the Boards at prices determined by the market value of their end products.

Creamery production of dairy produce was a late development in Scotland being associated with the decline in farm cheese-making. Farmers in the south-west were for long opposed to the idea of factory manufacture, but the trend was inevitable and it was not long before these plants provided a welcome, if not very remunerative outlet for milk. Historically the creameries in Scotland fall into two distinct groups—the private creameries and those run by farmers' dairy co-operatives—and the distinction was reflected geographically in the locations of the two groups (Fig. 3).

The private creameries. Since world competition demanded a supply of cheap milk for manufacturing purposes the private creameries were inevitably established in areas remote from the consuming centres where a surplus of milk (formerly manufactured on the farm) was available. The earliest of these, and incidentally the earliest of all the Scottish creameries, was started in 1882 at Dunragit in Wigtownshire. Both butter and cheese were made (the former, significantly, under the direction of a Dane) as well as large quantities of margarine which at that time was a dairy product in the real sense, being about 30 per cent butter. By the outbreak of war in 1914 there were ten private creameries operating in the south-west, at Dunragit, Stanraer, Bladnoch, Sorbie, Whithorn, Sandhead and Drummore in Wigtownshire, at Tarff in Kirkcudbrightshire, at Lockerbie in Dumfriesshire and at Kirkmichael in Ayrshire. Several were margarine factories and the Bladnoch plant remains to-day the source of all S.C.W.S. margarine though technological developments have long ago removed its geographical *raison d'être.*

The farmers' co-operative creameries. The early years of the twentieth century saw the development in Scotland of farmers' co-operative dairy associations on the Irish pattern. These were concerned primarily with sales to the liquid market and relied upon their collective bargaining to counter the increasing power of the city dairymen. Milk which could not find an outlet in the liquid market was manufactured at the collecting depot. Unlike the private concerns these early co-operative creameries, because of their interest in the liquid market,

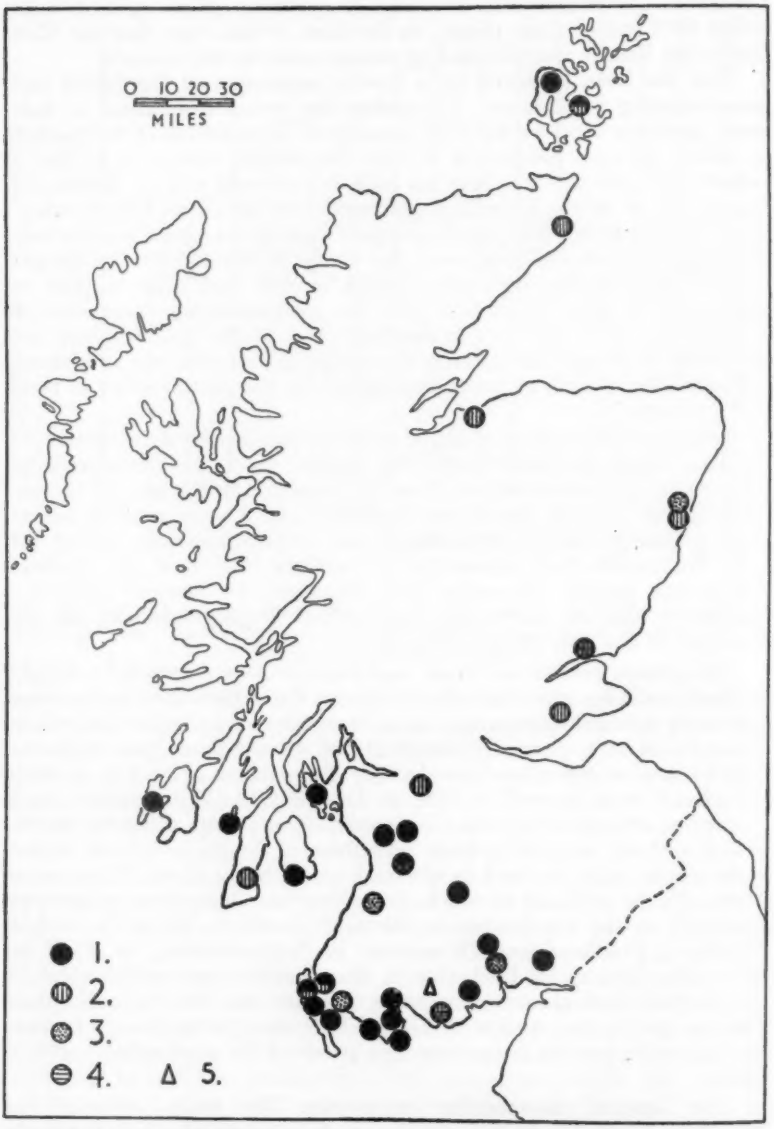


Fig. 2. Manufacturing creameries showing primary products (cream is not included) : 1. cheese; 2. butter; 3. condensed milk; 4. full-cream powder; 5. whey condensery.

were chiefly located within striking distance of the main centres of liquid demand. Significantly they were not common in the *immediate* vicinity of the urban areas, presumably because there the need for

co-operative action was less pressing. The main area was north Ayrshire where a group of seven associations was in operation before the First World War. After the War farmers' co-operative associations spread throughout most of the dairy region and the geographical distinction between private and co-operative creameries became confused.

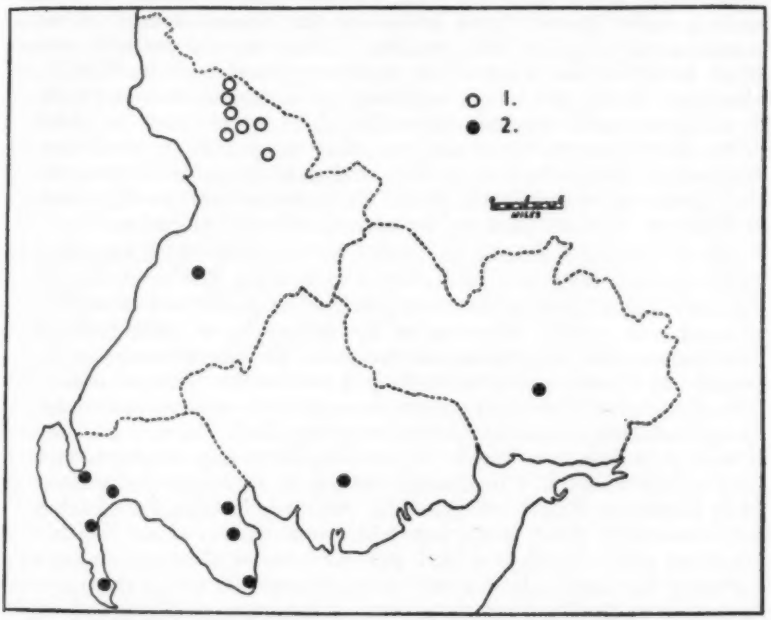


Fig. 3. South-west Scotland showing manufacturing creameries in operation in 1915 : 1. farmer's co-operative; 2. private co-operative.

The pattern of manufacturing creameries to-day is the product of seventy years of changing geographical circumstances and is therefore hard to analyse precisely. The creation of the Milk Marketing Boards in 1933 removed the need for local farmers' co-operatives and most of the little co-operative creameries were closed. Notable survivals are those at Fenwick and Kilmaurs which retain their original names though they are now owned by public companies and are part of a big dairy combine. Other farmers' co-operative creameries survived where they served a special function. The former Upper Nithsdale Farmers Creamery at Sanquhar, for example, was acquired by an English milk combine initially as a collecting depot for milk sent to London.

Perhaps the most notable development in the manufacturing field since 1933 has been the establishment in Scotland of a number of milk condenseries. Previously unrepresented north of the Border these condenseries are regarded as particularly valuable assets by the Boards on account of the relatively high price of milk sold for condensing. By far the biggest of these is the General Milk Products ("Carnation Milk") plant at Dumfries. Southern Dumfriesshire has no real tradition of farm manufacture and the G.M.P. Condensery effectively absorbed milk

previously sent to the liquid market in north-east England. This important export of milk from Dumfriesshire (and to a lesser extent from Galloway) to the industrial centres of north-east England was stopped in 1934 after negotiations between the English and Scottish Boards. Even so, the available local supplies could not meet the requirements of the condensery and for many years a special milk-train made a daily journey from Aberdeen, the nearest source of extra manufacturing supplies. This paradoxical situation was partially rationalised in 1958 when a subsidiary condensery was built by G.M.P. in Aberdeen. Now a set of ten rail-tanks carry several thousand gallons of condensed milk once a week to Dumfries for canning. In addition to the G.M.P. plants there are two other whole-milk condenseries in Scotland, at Kirkmichael in Ayrshire and at Dunragit in Wigtownshire. Until it was taken over by the Nestlé Company in 1940 the old creamery at Dunragit was still used for the manufacture of margarine.

Of the fourteen creameries owned by the Milk Marketing Boards five originated as farmers' co-operative creameries. The remainder were specially built in areas of actual or potential surpluses and as such were planned with careful reference to the geography of milk production and consumption. The Mauchline creamery, for example, was carefully planned at a point calculated to be just outside the Glasgow milk-shed throughout most of the year yet near enough to the city and conveniently enough situated to send milk there when required. The new Glenrothes creamery in Fife is a simple response to increasing surpluses in that part of the country. Functionally unique in Scotland is the Scottish Milk Marketing Board's Hogganfield creamery in Glasgow which acts as a balancing point collecting milk from areas where day-to-day surpluses arise, distributing such milk to areas of shortage, and manufacturing the surplus. It also manufactures non-T.T. milk (which is now barred from the liquid market) from as far away as Oban and sends T.T. milk to make up the deficiency. Cream which is separated by the farmers on the Island of Coll similarly ends as butter at Hogganfield.

It will be noted that Figure 2 refers to primary products only. In addition to these most creameries manufacture at least one by-product (skimmed-milk powder, whey-butter, casein etc.). The full utilisation of the residue from butter and cheese-making has been a relatively late development and for many years the effluent from creameries created a problem that went beyond economics into the sphere of social welfare. Stream pollution in particular was serious. The problem did not usually arise on the cheese farms where the pig population was usually more than sufficient to absorb the whey produced, but in the case of a creamery producing several thousand gallons daily it was very real. A number of creameries did in fact have piggeries annexed but it is doubtful if many were serious economic undertakings and the problem of surplus whey remained. In 1929 it was estimated that fully 75 per cent of the whey produced by Scottish creameries was waste. [4] Since then technological developments, particularly in the field of whey-condensing, have virtually solved the problem and only occasionally now does the subject of creamery effluent enter into the minutes of the local authorities. One notable development has been the United Creameries whey-condensery at Tarff. This plant, established in 1938, absorbs the whey

from six Galloway creameries and processes an average of 20,000 gallons a day over its eight-month operating period. Much of the lactose produced is used in the preparation of penicillin, an interesting illustration of the varied uses of milk derivatives.

Since the creameries function basically as outlets for milk which is surplus to liquid requirements their manufacturing intakes suffer much greater seasonal fluctuations than does milk production, and this in itself is considerable. Wide seasonal variations in intake raise all the well-known economic problems of providing for the peak period capacity which is partially redundant for the rest of the year. It is clearly in the interest of the industry that so far as possible the manufacturing creameries be assured a certain minimum intake throughout the year. Even so, several creameries usually cease manufacturing for a few days in winter when their normal intake is diverted to the liquid market, and three creameries cease manufacturing entirely for the winter months. Fortunately this marked seasonality is not reflected in labour problems for the dairy trade has a quick labour turnover in any case and key workers are easily absorbed on maintenance work in winter.

The seasonal variation in milk manufacturing are shown on Figures 4 and 5. It will be noted that there are wide variations in the summer/winter intake ratios between creameries. The explanations of these variations are several. It is clear, however, that in general terms the seasonal variation in the production of any one creamery can be explained in terms of (1) the seasonality of milk production in the normal 'catchment area' of the creamery, and (2) the extent to which milk in this area is tapped to maintain supplies to the liquid market in winter. These will be considered in turn.

Seasonality of milk production. The markedly seasonal nature of milk production has ramifications throughout the entire structure of the industry and the issue is further complicated by wide regional variations in the degree of seasonality. These are shown on Figure 6. At the risk of irrelevance it might be pointed out that wide regional variations are known to exist in seasonality of production in almost every branch of livestock husbandry and hardly any of these have been mapped, far less adequately explained. In the case of milk supplies the factors responsible for these variations are undoubtedly complex since seasonality of production is known to be affected by a variety of very different environmental circumstances. Barnes, for example, has explained the pattern in England in terms of "grass or arable dominance", [5] while Phillips, Davies and Brown sought to explain the pattern in North Wales in terms of "climatic conditions, particularly the hours of bright sunshine during the winter months" and their effect on the breeding performances of cows and heifers. [6] A careful analysis of the dairy region of south-west Scotland, too lengthy to include here, strongly suggests that the main factor is sheer tradition from the days of farm-house cheese-making. The areas of greatest seasonality are those where farm cheese-making (a purely seasonal business) persisted longest. The doubtful financial advantages of winter production can take a long time to induce changes in a traditional calving regime to which the seasonal routine of farm work has been geared for generations.

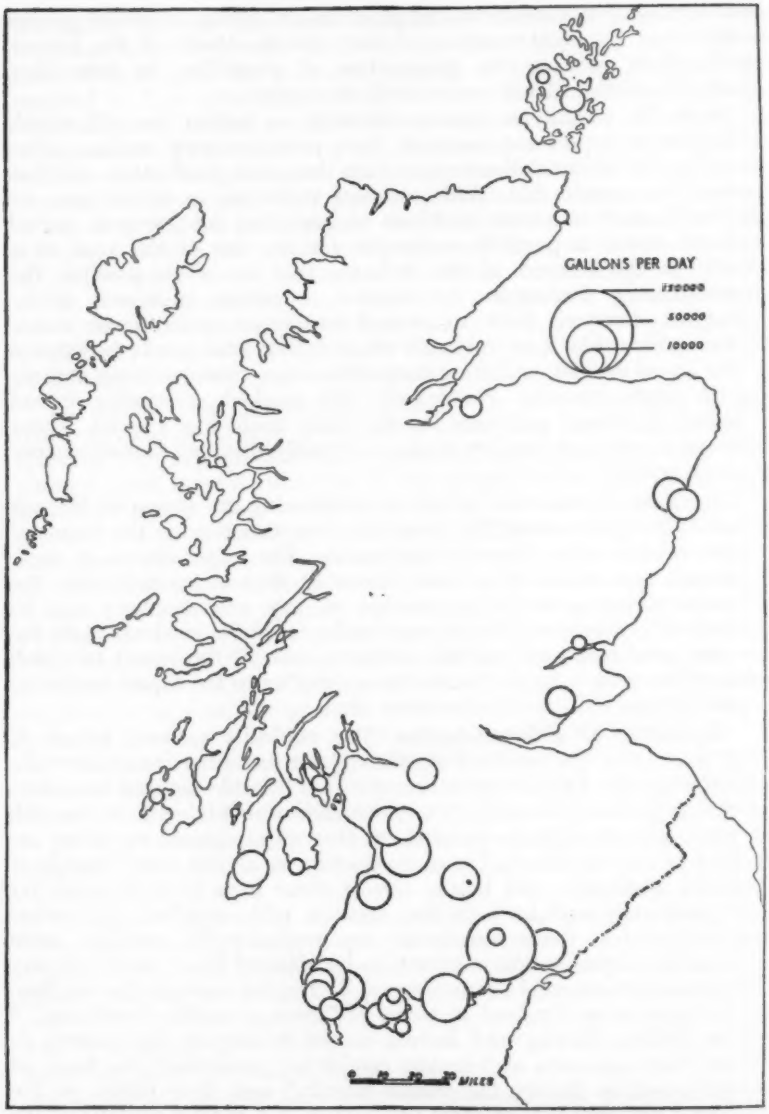


Fig. 4. Manufacturing creameries—summer intake. Intake for liquid distribution not included; that at Nairn includes cream from 4000 galls separated at Elgin.

Diversion to the liquid market. Most of the creameries function in winter as depots for the collection and dispatch of milk to the liquid market, a service for which they are paid a handling allowance by the Board. Milk passed through in this way represents a direct diversion away from manufacture. In addition milk may be diverted directly

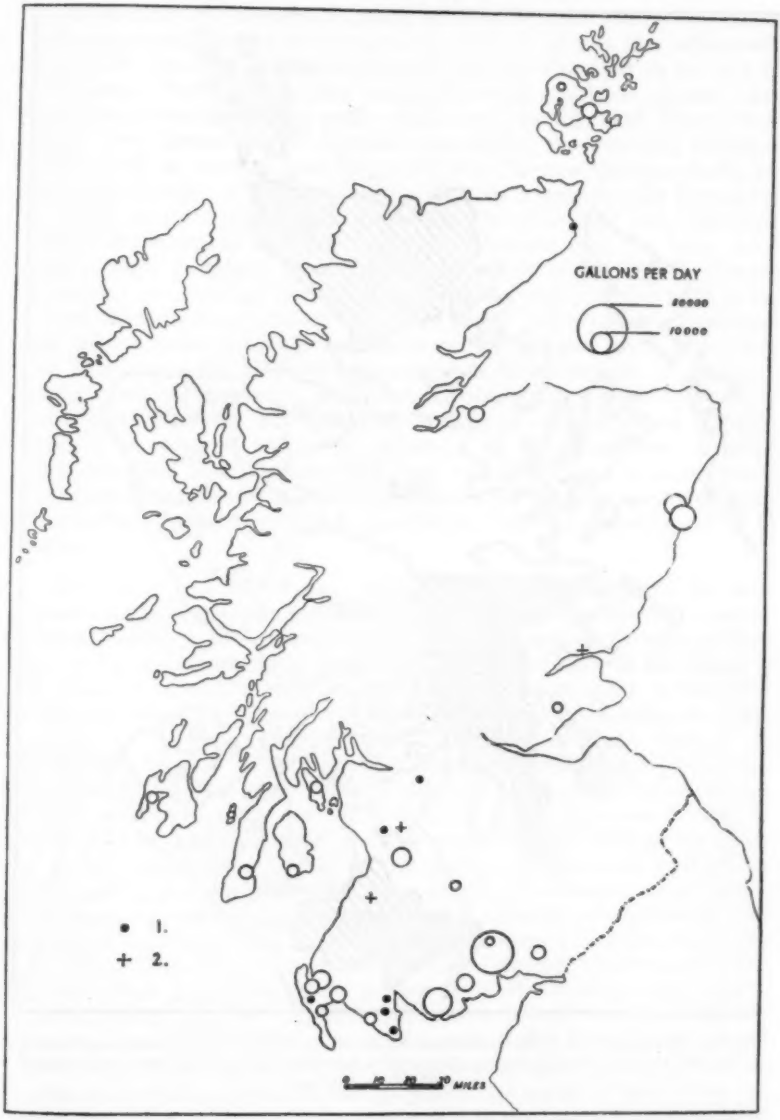


Fig. 5. Manufacturing creameries—winter intake. Intake for liquid distribution not included: that at Nairn includes cream from 1500 galls separated at Elgin: 1. manufacture normally stops for a short period; 2. no winter intake

from the farms to the liquid market so reducing the 'catchment area' of the creamery. The extent to which milk is diverted from or through a creamery again depends on a number of circumstances the least important of which is distance from the liquid market. There is for

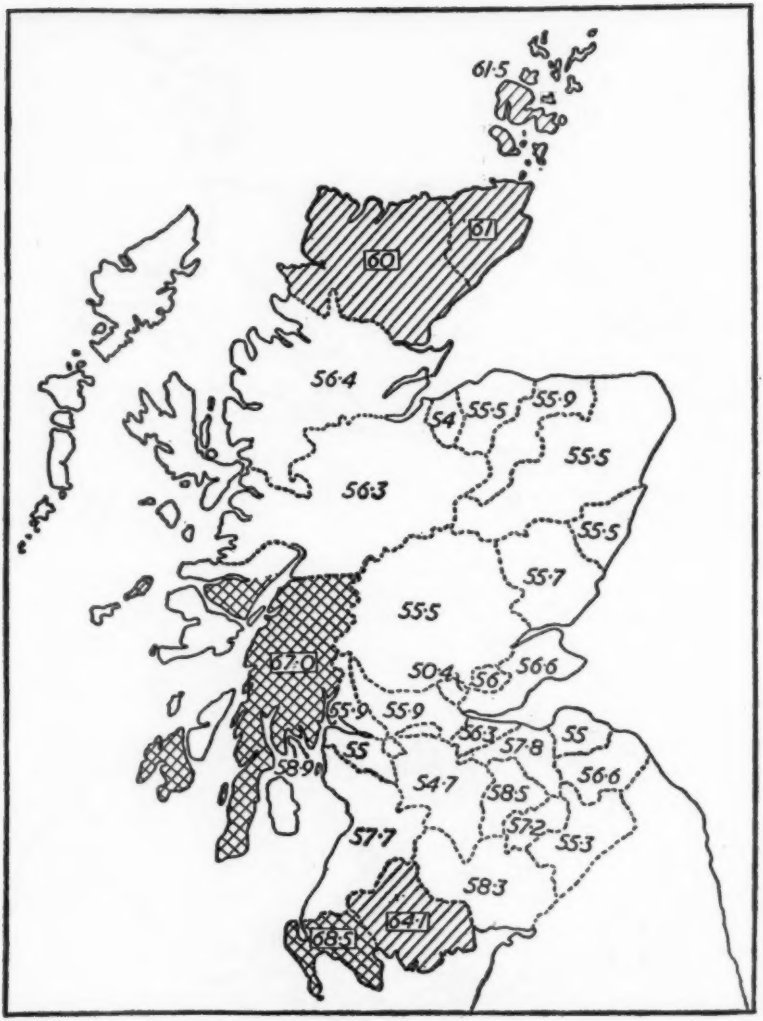


Fig. 6. Seasonality of milk production by counties, 1958. Figures refer to percentage of annual total produced during six months March-August. 60-65 per cent shaded: over 65 cross-hatched.

instance a strong case for diverting milk first of all from those creameries which are paying the lowest price. The importance of considerations like these is perhaps best illustrated by the fact that in winter the City of Edinburgh receives much of its milk supplies from the Wigtownshire cheese-creameries while huge gallonages (about enough to supply the city two times over) are manufactured in Dumfries. With surpluses much reduced in winter the Boards have clearly more opportunity to decide just where these surpluses should be.

In summer this element of choice is severely restricted by the manufacturing capacities of the creameries and in places this effectively limits the extent to which surplus milk can be absorbed in its area of production. The result is that creameries with available capacity can find themselves absorbing milk which has 'spilled over' from somewhere else. Several of the Ayrshire creameries, for example, normally receive milk in summer from Hogganfield in Glasgow, the manufacturing capacity of which is 18,000 gallons a day. As a general rule the recent increases in production have meant that in May and June the milk produced within the Central Lowlands industrial zone has been more than enough to satisfy the liquid requirements of the region. Consequently it has become normal at that time of the year for milk to be passed through the premises of certain of the big wholesale dairymen and sent to manufacturing creameries in the remoter parts. Thus it is that in summer the Dalbeattie creamery in the Stewartry of Kirkcudbright commonly receives milk from Edinburgh, a curious reversal of the winter-milk flow. Taking the creameries of the south-west together there is at present no overall shortage of manufacturing capacity (though certain ones at times 'spill over' into others) and in recent years they have been able to manufacture additional supplies imported from Cumberland where increased production has far outstripped local markets.

Since it is true to say that, subject to the limits imposed by their manufacturing capacities (and these can easily be increased if supplies are forthcoming), the creameries will gladly take as much milk as they can get, it is perhaps unfair to speak of milk surpluses at all. There is no question of milk being poured down the drain. This is the view commonly taken by those dairy farmers who have been lucky or clever enough to increase their production and/or efficient enough to compensate the fall in pool price. It would be irrelevant to pronounce on this political issue here. What is clear is that if production continues to rise and the Government's view that the industry is now too big to be healthy is accepted some positive measures will have to be taken to curtail production. Added to the present disincentive created by prices failing to keep pace with rising costs such measures must inevitably encourage producers with a choice of farming enterprises to give up milk production. Even at present those farmers who have the choice of going over to grain or beef are showing a distinct trend out of milk. On the other hand, the dairy farmer in north Ayrshire with eighty acres of good grass on a heavy, cold soil is severely restricted in his choice of enterprise. In order to make a reasonable living from a small family farm a degree of intensive production, not possible with store cattle, is normally necessary, and in places like north Ayrshire climatic conditions effectively preclude commercial grain production. For dairy farmers in this position the most obvious way to beat a falling milk cheque is to increase production by better feeding and if possible a greater stock-carry, so joining the vicious circle. Thus it is to be expected that further disincentives to milk production will result in greater regional disparities in production trends with some areas moving to beef or grain while others boost production to keep up the milk cheque. Something of this can already be seen in the milk production

and dairy-cow figures summarised in Table 1. It is a significant fact that although milk production has risen by almost 7 per cent in the last four years the national dairy herd has declined in the same period. It is clear that a large part of the present increases in milk production are due to increases in the average yield per cow resulting from improved management and the general benefits of intensive research. It would

Decrease in Cows and Production			Decrease in Cows but Increase in Production			Increase in Cows and Production		
	Cows	*Prodn*		*Cows*	*Prodn*		*Cows*	*Prodn*
Bute	—4.4	—2.5	Aberdeen	—1.8	+8.3	Ayr	+1.1	+9.3
Clackmannan	—1.6	—7.5	Angus	—2.7	+8.5	Dumfries	+1.7	+5.5
Dunbarton	—3.2	—1.1	Argyll	—8.6	+1.1	Fife	+4.3	+7.2
Inverness	—19.8	—1.1	Banff	—4.9	+5.4	Kincardine	+0.3	+8.7
E. Lothian	—10.3	—0.4	Berwick	—9.3	+3.8	Kinross	+1.4	+1.7
Midlothian	—7.8	—2.9	Caithness	—14.8	+4.2	Kirkcudbright	+0.6	+3.7
Selkirk	—10.7	—3.7	Moray	—2.8	+5.2	Lanark	+1.6	+11.2
Ross & Cromarty	—22.8	—6.9	Nairn	—21.7	+1.2	Orkney	+1.8	+20.3
			Perth	—2.3	+7.2	Peebles	+1.7	+8.7
			Renfrew	—6.4	+5.4	Zetland	+12.7	+2.8
			Roxburgh	—9.2	+11.8	W. Lothian	+0.9	+11.6
			Stirling	—3.1	+1.6	Wigtown	+2.5	+7.5
			Sutherland	—25.5	+16.4			
			SCOTLAND	—1.7	+6.8			

Table I. Percentage changes in dairy-cow numbers and milk production, 1957-1961 (year ending March 31st). A comparison of two single years can be misleading for unusual weather conditions may be reflected in production. Where the object is regional comparison this is not a serious problem, and in any case the two years for which the figures have been extracted were not appreciably affected in this way.

Sources: The Scottish Milk Marketing Board, The Aberdeen and District Milk Marketing Board, The North of Scotland Milk Marketing Board, The Dept. of Agriculture and Fisheries for Scotland. Figures for Zetland, which is not covered by any of the Boards, were obtained from the Sanitary Authorities and are not strictly comparable with those for the other counties.

not be reasonable to expect farmers to reduce efforts in that direction. Of the thirty-three Scottish counties only twelve have increased their dairy-cow population in the last four years, yet all but eight have increased their production. No clear regional pattern has yet emerged except that the areas of greatest decrease (both cows *and* production) are for the most part outside the traditional dairy regions. The five biggest milk-producing counties (Ayr, Lanark, Wigtown, Dumfries and Kirkcudbright, in that order) have all shown significant increases in both cows and production in recent years. How far these trends will continue remains an open question. It seems likely that those areas showing a decline will continue in that direction, but the actual quantity of milk involved in these cases is, in national terms, small. In the traditional dairy regions, (which are responsible for most of the recent increase) lack of flexibility in the use of the land, large sums of capital sunk in dairy buildings and a general outlook which tends to equate farming with milk production could well thwart all but the most rigorous controls over production.

[1] McMaster, J. Scotch Cheese Making. *Trans. High. Agric. Soc. Scot.*, 1885, XVII, p. 215.
[2] Sturrock, A. Agriculture of Ayrshire *Trans. High. Agric. Soc. Scot.* 1866-67, 1, p. 93.
[3] Speir, J. Dairying in Scotland *Trans. High. Agric. Soc. Scot.*, 1886, XVIII, p. 332.
[4] Macneilage, A. *Surplus Milk and Milk Residues* Hannah Dairy Res. Inst. Bull. No. 1, 1929.
[5] Barnes, F. A. Evolution of the Salient Patterns of Milk Production and Distribution in England and Wales *Trans. Inst. Brit. Geogr.*, 1958.
[6] Phillips, Davies and Brown. Seasonal Distribution of Calf and Milk Sales in North Wales. *Journal of Dairy Research*, 1949, 16, p. 138.

R.S.G.S. CARTOGRAPHIC SECTION: REPORT ON SESSION 1960-61

At the outset of the 1960-61 session of the Society's winter activities the Council gave approval to the formation of a Cartographic Committee who thereupon undertook the organisation of a Cartographic Section within the membership of the Society. This Section has now completed its first session which has proved even more successful than had been hoped.

A programme of four evening meetings has been carried out in the Council Room of the Society, which, on two of these occasions, was filled to capacity. This was the case at the opening meeting held on the 3rd November, 1960, when Mr John S. Keates, of the Geography Department of the University of Glasgow, addressed the Section. His topic was "Recent Trends in Cartography" and at the close of this talk some lively discussion took place. Mr Keates was assisted in the considerable task of answering questions, by a panel of members of the Society who are also professional map-makers. The meeting was honoured by the presence of M. Stephane de Brommer of the I.G.N., Paris, who also took part in the panel discussion. In addition to ordinary members of the Society, the meeting was attended by members of the Universities of Glasgow, Aberdeen, Edinburgh, Durham and Belfast, professional cartographers from the three cartographic houses in Edinburgh and from two of the London houses, school teachers and visitors from various scientific societies.

So successful was the opening meeting that it was decided to hold a second meeting soon after it. This meeting, held on the 9th December, 1960, took the form of a film show and discussion. Films demonstrating modern methods of photogrammetric map-making, as practised in Switzerland, were kindly provided by Messrs Hall Harding, representatives of the Swiss firm of Wild Heerbrugg Ltd. At the close of the showing Mr Gordon Petrie, Lecturer in Surveying and Photogrammetry at the Univeristy of Glasgow, very competently replied to questions which had been stimulated by the films.

The emphasis placed on aerial survey methods at the previous meeting prompted the topic of the third meeting to be "Ground Survey" and on this occasion, February 3rd, 1961, the Section was fortunate to have the services of Major A. C. Marles, and Capt. R. H. P. Dugmore, regional officers of H.M. Ordnance Survey. These two speakers laid emphasis on a simple explanation of conventional surveying methods, an approach which was greatly appreciated by the large number of school teachers in the audience that evening.

The concluding meeting of the Section took place on the 21st April, 1961, when members heard Mr D. R. MacGregor and Mr Keates, lecturers in Cartography at Edinburgh and Glasgow Universities respectively, discuss the question of the portrayal of relief on maps.

A further concern of the Committee has been the compilation of a book list of cartography and last session the first part of this was circulated to members. Other parts will be issued from time to time.

Preparations for next session have been made and the Committee has composed a further programme of meetings for session 1961-62. These will be held in the Department of Geography at the University of Edinburgh and full details will be found in the Society's Prospectus. These meetings have been arranged with a view to providing a programme which will make the second session of the Cartographic Section fully as interesting and as varied as the first has been.

THE 'INSTITUT GEOGRAPHIQUE NATIONAL' OF FRANCE

STEPHANE DE BROMMER

The production of the first 'topographic' maps, in the true sense of the word, hardly goes back beyond the beginning of the sixteenth century. These maps were at that time drawn for strictly military purposes, and in France the military survey engineers had a common origin with the Corps of Engineers.

During the reigns of Henri III and Henri IV there existed the "engineers of camps and armies and of towns and provinces" sometimes called "*Ingénieurs ordinaires du Roi*". The most notable of these was Sébastien le Prestre, seigneur de Vauban, who introduced into the survey of numerous fortified sites, a degree of accuracy hitherto unknown. In 1668 Louvois, Minister of War to Louis XIV created the first service called upon to assemble and maintain the cartographic documents necessary to the Army. Then, early in the nineteenth century, the *Dépôt des cartes et plans* was merged with the *Dépôt de fortifications* to form the *Dépôt de la Guerre* (War Depot) to which the survey engineers were attached. With the invention of triangulation as a method of survey and the progress achieved in optical instrument construction, topographic detail could be based on a framework of points forming a coherent net. As a result of these first geodetic operations, the maps known as *cartes géométriques* became precise documents with a mathematical foundation based on a knowledge of the Earth's dimensions.

The first map of the whole of France was the work of Cassini de Tury, who undertook the measurement of the meridional arc. The method of relief representation by contours was perfected about 1800 by Commandant Haxo; in 1802 a commission fixed the conventional signs, metric scales and direction of lighting to be adopted to represent the shape of the ground, etc. Surveyors, who numbered 103 in 1809, were recruited from amongst graduates of the *Ecole Polytechnique* and a school of instruction was created. After 1814 general staff officers were attached to the survey engineers and the two groups were merged. A government commission was appointed to study the project of a new topographic map of France, known as the *carte de l'Etat-Major* (General Staff Map), drawn to a scale of 1 : 40,000, based on the triangulation by the survey engineers and on Bonne's projection; the compilation and publication were carried out at a scale of 1: 80,000. The ground relief was represented by hachures. Although this map is over 100 years old, it is still and will be for some years, the only topographic map which covers the whole of France; a map, at a scale of 1 : 320,000 was produced from it.

Meanwhile, the headquarters of the *Dépôt de la Guerre* was disbanded, the Depot itself becoming attached to the General Staff of which it formed the Sixth and later the Fifth Bureau. It was the task of General Perrier to set up, in 1881, a new specialist organisation,

la Section Géographique de l'Etat-Major (Geographical Section of the General Staff). In 1884 the *Dépôt de la Guerre* was temporarily reconstituted to be replaced, in 1887, by the *Service Géographique de l'Armée* which existed until 1940; at the start this was practically only a change of name. A specialised printing works, using zinc plates instead of lithographic stones, was set up in 1885 in the Staff College in Paris, and this building was completely modernised and air-conditioned in 1956.

A Central Commission for Geographical Projects was established in 1890 to co-ordinate the work required by different government departments; this Commission has now become the *Comité Central des Travaux Géographiques* which meets each year. In 1911 General Berthaut saw to it that the *Service Géographique* was granted some independence, ceasing to be part of the General Staff, and this eased its task as a map-producing agency. Although as long ago as 1878 a commission composed of delegates from the Public Works, Interior and War Ministeries proposed a new map of France at 1 : 50,000 in colour and with contours, the number of sheets actually published between 1898 and 1914 remained small, on account of delays brought about by financial restrictions.

During the course of the First World War, the needs of military operations and the development of artillery brought about a modification of the ideas then current in mapping. The value of larger-scale maps at 1 : 20,000 and sometimes even at 1 : 10,000, which were known at that time as *plans directeurs de tir* (artillery ranging maps), was recognised. By overprinting a rectangular grid it became possible to plot each point by its co-ordinates. After the war, the polyhedral projection was replaced by Lambert's conformal projection, and the survey of a contoured map series at 1 : 20,000 was undertaken. Colonel Laussedat had envisaged, as long ago as 1851, a photographic method of survey; after long series of experiments plotting from vertical air photos was carried out regularly from 1928 onwards as a result of the establishment of an optical research laboratory and the invention of the Poivilliers Stereotopographic plotting machine.

The restrictions on military personnel imposed by the armistice of June 1940 forced General Hurault to dissolve the *Service Géographique de l'Armée*. It was thus that a new civilian organisation was formed on the 1st of July, 1940, under the wing of the Ministry of Public Works bearing the name *Institut Géographique National* (commonly known as "the I.G.N."). The functions of the new institute, heir to a very ancient body, were considerably extended by the inclusion of the *Service du Nivellement Général* (National Levelling Service), which was founded in 1884 under the direction of the Ministry of Public Works, and by the absorption of the various overseas survey services. The I.G.N. is thus charged with the provision of geodetic, topographic and cartographic material, not only of Metropolitan France, but also of the various overseas territories. The advantages of this situation are numerous, as much from the point of view of recruitment, the technical skill and stability of personnel, as from the allocation of funds and the possibility of undertaking varied geographical projects of national or private interest. This resulted in the Institute's civilian status being continued after the end of the Second World War.

Further to this, a *Groupe des Escadrilles Photographiques* (Aerial Photographic Groups) of the *Institut Géographique National* was organised, gathering together the highly specialised staff and the specially adapted equipment that are indispensable to provide, under the best conditions, the aerial-photo coverage required by modern photogrammetric techniques.

L'Ecole Nationale des Sciences Géographiques (National School of Geographical Sciences), which is attached to the I.G.N., provides the different categories of civil servants in the I.G.N., both to ensure their initial training, and for their up-grading during the course of their careers. This school also accepts individual students, French military trainees, a large number of foreigners, and its training is open to anyone interested in the techniques being applied. The teaching, which is provided by specialist instructors belonging to the staff of the I.G.N., or to the University, covers the whole field of the fundamental techniques of geodesy, topography, photogrammetry and cartography. The complementary scientific knowledge necessary for a perfect understanding of these disciplines is provided by various courses: applied mathematics, optics, geography, geology, geophysics, radio-electricity.

To meet the various tasks assigned to it, the I.G.N. is divided into different 'directorates' under the control of a general directorate which is directly subordinate to the Minister of Public Works. One directorate is entrusted with personnel matters, administration and accounting. A second has the task of providing all astronomical and geodetic determinations, as well as being in charge of levelling operations. It has to maintain all triangulation points and bench marks, and to provide for general use the data necessary for the execution of routine survey work. The first-order geodetic framework is now complete in Metropolitan France, and the second, third and fourth-order frameworks are well on the way to completion in a few years' time. A computing laboratory, equipped with electronic computers and punch-card sorting machines, makes possible the speeding up of computations, and the rapid listing of co-ordinates. Land surveys are carried out by a third directorate, comprising topographic and photogrammetric departments, to which are attached the photographic squadrons which will be referred to again later.

The old method of plane-table surveying on the ground is much too slow and is little used except for training purposes. At present, all maps are prepared by the stereo-plotting of aerial photographs, and the photogrammetric department of the I.G.N. is one of the largest in the world. It is almost entirely equipped with French instruments, invented by Monsieur Poivilliers and constructed by S.O.M. *(Société d'Optique et de Mécanique de Haute Précision).* The Poivilliers Stereotopograph (type B) is used for the most precise work especially at large scales. The Poivilliers type D is particularly suited to surveys at medium and small scales. Finally, the Stereoflex and the Stereophot are the simplified third-order instruments. In all, 128 stereo-plotting machines are at present in service. Field work is limited on the one hand to the establishment of the ground control necessary for orientation when stereoplotting, and on the other hand to the field editing of the map. In the course of the last few years, annual production has reached:

15,000 sq. km. surveyed at 1/20,000 for the maps of France: 100,000 sq. km. surveyed at 1/50,000 for overseas mapping; 250,000 sq. km. surveyed at 1/200,000 for the Saharan region. Copies of all aerial photographs are kept at the *Phototèque Nationale* (National Photo-Library) where contact prints or enlargements are available to the public.

Starting from the machine-plots, the draughting and reproduction of the maps are carried out by a fourth directorate. Finally, there are various outlying branches in Algiers, Rabat, Brazzaville, Yaoundé and Tananarive.

The aerial photographic service (G.E.P.) deserves particular mention because it constitutes a rare example of an organisation specially created and adapted for the purpose of taking air photos not only in France, but in any part of the world. The photographs are generally taken on glass plates (19 x 19 cm) so as to obtain maximum precision, but other cameras permit the use of black and white, or colour film. The aircraft are equipped for simultaneous exposure of panchromatic and infra-red films, the latter revealing water areas, and facilitating, for instance, the study of vegetation. The scales of photography are generally 1 : 25,000 for the systematic coverage of France (which is repeated every 8 years), 1 : 50,000 for overseas, and 1 : 70,000 for the Sahara; and larger scales are used for special studies. These means have enabled the coverage of 2,400,000 sq. km. to be carried out in one year, and a total surface area of 15,000,000 sq. km. has thus been photographed. Several foreign governments have asked for work to be carried out by the Photographic Groups—a tribute to the excellent results obtained by their crews.

The main task of the I.G.N. in Metropolitan France is the production of a 1 : 20,000 base map, which at the moment covers approximately half the country. At the same time, some new sheets are being published at 1 : 25,000 to meet military requirements. From this base map is derived a 1 : 50,000 map which is gradually replacing the old series at the same scale obtained by enlargement of the old *carte de l'Etat-Major* at 1 : 80,000. The publication of a new map at 1 : 100,000 has recently been undertaken, on which the road pattern is brought out by additional red and yellow printings. Besides the general map of France at a scale of 1 : 200,000, the compilation of a series at a scale of 1 : 250,000 has been started for military use. In overseas territories the scales used vary from region to region, the most usual being 1 : 50,000, 1 : 100,000 and 1 : 200,000. It is impossible to list here all the numerous other miscellaneous maps for which the I.G.N. is responsible, but it is sufficient to say that on the average, the I.G.N. produces three new maps every day. Moreover, the I.G.N. does not limit itself to the production of standard topographic maps. It is frequently necessary to produce photo-mosaics (by the simple joining-up of adjacent air-photos) or photo-plans (the joining up of rectified photographs positioned according to the ground control).

Local surveys at large scales, varying from 1 : 2,000 to 1 : 20,000 (often at 1 : 5,000) are asked for with increasing frequency for motorway planning, alignment of oil and gas pipelines, industrial or even agricultural planning. Every year, there are requests for the survey of longitudinal profiles of watercourses, and for levelling operations to

determine land subsidence in mining areas. New applications of photogrammetric techniques are constantly being found for industry, architecture, glaciology, photo-geology, archaelogy: as examples, one might mention evaluation of coal stocks, examination of hydro-electric dams, determination of missile trajectories, the study of wave movements, the verification of surface forms (e.g. comparison between reduced models of turbine blades and their full-scale realisation) etc.

At the request of U.N.E.S.C.O. photographs were taken along the Nile in Egypt to help in safeguarding the historic treasures liable to be flooded by the new Aswan Dam. Some sculptures of the Abu-Simbel Temple were the subject of photogrammetric stereo-plotting, thus enabling the bas-reliefs and the bust of Rameses to be reproduced. In another field special collections of photographs showing particular morphological features have been produced for a stereoscopic projection as a teaching aid.

All large modern engineering projects depend on an accurately measured basic framework. In this respect the *Institut Géographique National* took part in the exploratory surveys for the Mont Blanc and Channel Tunnel Projects. The precision equipment installed in its laboratories recently enabled the tracing of the grooves to be made on a recording intended for an electronic computing machine. Two engineers have been detached to the European Centre of Nuclear Research (CERN) at Geneva where they have dealt with the geodetic problems inherent in the construction of the synchrocyclotron.

Translated by John C. Bartholomew and Gordon Petrie

R.S.G.S. GLASGOW
TRAVELLERS' SECTION

Another successful series of Meetings has just been completed. Members continue to show their pictures taken on recent journeys. Three subjects as varied in locality as possible make up the programme for each meeting. Recently we have seen and heard about *The Shetlands — Dolomites to Venice* (Walking Tour) — *Ladakh and Baltistan* (Outer Kashmir) — *Greece — The Basque Country.*

The average attendance during the past series has been 120 and since the Section was formed in November 1959, 30 members have taken an active part in over the 11 programmes.

Further interested members will be very welcome.

Please see Glasgow Prospectus for details.

REVIEWS OF BOOKS

EUROPE

The Relief and Drainage of Wales. By E. H. Brown 10 × 6¼. Pp. XIII + 186. 24 plates. 47 figs. Folding map inside back cover. Cardiff : The University of Wales Press, 1960. 30s.

There have been attempts to understand the geomorphology of Wales, many of them local and particular, a few comprehensive but shallowly founded. Dr Brown provides the first thorough and coherent synthesis that brings together all the major elements of landscape of pre-Glacial age. In doing so he incidentally also summarises in an illuminating historical account the growth of geomorphological thought from Ramsay's first essay of 1846 to the present day.

The book is of the highest value. It is based on a personal exploration of the whole country that allows the author to place at first hand the work of others in his own conspective view. It is full of objective description, and, quite apart from its theory, it presents an excellent perspective of landscape not biased by over-emphasis on selected features or on preferred inference.

In his major conclusions the author tends to confirm and to give more substance to what has been suspected for a long time. However the geomorphic profile is interpreted in detail, its main elements appear to be a product of repeated uplift and regional rejuvenation, seen in a succession of platforms or peneplains rising perhaps to the highest summits. The lower platforms, up to about 650-700 feet, he ascribes to pulsatory fall in sea level of late-Pliocene or Pleistocene age. The upper, which he assembles into three principal groups — the Low Peneplain at about 700-1,100 feet, the Middle Peneplain at about 1,200-1,600 feet, and the High Plateau at about 1,700-1,900-2,000 feet — he regards as of subaerial origin, without being too explicit in explaining the change in either erosional process or regional geography. He integrates the highest monadnock peaks into a Summit Plain, which he thinks may reflect, perhaps at a remove, a former Cretaceous cover. He ascribes the primary drainage, now greatly modified by piracy in a progressive growth of subsequents adjusted to structure, to radial fanning on a mature surface gently inclined from a source in the region of the north-western mountains.

His theory is stimulating and provocative. It is convincing in many of its elements, particularly in its interpretation of the lower platforms and of the pattern of drainage. But it lacks complete conviction in its concept of stepped peneplains, and there is a possibility that a more refined analysis of the relationships of regional peneplains to the benches in rejuvenated valleys would have provided a clearer insight into process : it is manifest that as now conceived the peneplains are composite, and each incorporates elements neither of the same age nor of the same mode of origin. Nor is there any hint of the location of the contemporary shores of these peneplains — which must have lain many miles beyond the present limits of Wales, in England and Ireland perhaps, or in the North Sea and the Atlantic. Similarly the initial drainage is accepted without much regard for the process of its inception, the vague and unconvincing restoration of a deformed Summit Plain and the conjectural reference to superimposition from a Cretaceous cover being with difficulty reconciled to a chronology of the peneplains and platforms that is wholly later Tertiary.

The book is illustrated with many text-figures most of which effectively further the description and the argument, and many of which, field sketches and profiles, happily combine evidence with interpretation. Two folding maps, one coloured, show the distribution of lower platforms and upper peneplains respectively, as recognised by the author. The 24 half-plate photographs contribute substantially to the reader's apprehension of the landscape : it is a pity that some of them are poor in quality.

As a whole, the book is a timely and outstanding contribution to British geomorphology; it is both satisfying in itself and a stimulus to more extended study; and its methods and its conclusions are directly relevant to most other areas of oldland Britain.

T. Neville George

The Cardiff Region. A Survey prepared for the Meeting of the British Association held in Cardiff. By J. F. Rees (Editor). 10 × 7¼. Pp. XV + 222. 22 figs. 24 plates. Cardiff: University of Wales Press, 1960. 21s.

Prepared for the September 1960 meeting of the British Association held in Cardiff, this Survey is the work of 32 contributors invited by an Editorial Committee of five University Professors with Sir Frederick Rees, a former Principal of University College, Cardiff, as Chairman. The handbook is a credit to all concerned and, not least, to the University of Wales Press Board and to their local printers for the excellence of its craftsmanship.

The fifteen chapters fall naturally into three parts: physical, historical and economic and cultural. The geographer will find an admirable first chapter by Dr Margaret Davies on landscape and climate, a great deal of first-rate material on geology, botany, agriculture and forestry, and a less-detailed analysis of the demographic and economic aspects of the region. The historical section surveys in some seventy pages of text the ways of life of the region from the days of early man to the industrial developments of the last twenty years. The treatment of each period is necessarily somewhat condensed and selective. The third part dealing with the literary traditions of the area and the Welsh language is hardly within the field of geography but it has an excellent short chapter on Welsh place-names.

In the book the Cardiff Region is vaguely defined as the area of East Glamorgan, Monmouthshire and South Breconshire; to the student of natural regions it is pleasing to note how closely the sub-divisions defined by the various specialists are in general agreement. If your reviewer, himself Welsh-speaking, has to express one disappointment it is that the book does not succeed in conveying to him the breadth and soul of the Cardiff Region; but, maybe, it no longer has a soul.

D. T. Williams

The Mineral Wealth of Wales and Its Exploitation. By T. M. Thomas. 5¾ × 9. Pp. XV + 248. 47 figs. 13 plates. Edinburgh: Oliver & Boyd, 1961. 30s.

The book contains an introductory chapter on the geological basis of the country's wealth, two chapters on coal and coal mining, and one each on slate and its extraction, limestone quarrying, igneous rocks, sands (grit stones or greywackes), clays (shales and marls), fire-clays, dolomite, sand and gravel, iron ore, lead and zinc, gold and gold mining, copper, manganese, and a final chapter on miscellaneous minerals or other natural deposits of economic significance. Appended to each section there is an extensive bibliography of the Geological Survey Memoirs, the Special Reports on Mineral Resources and of books and papers of general interest. The book is profusely illustrated with geological maps, distribution maps of brick-works, quarries, etc., and also with vertical and oblique aerial photographs.

The work is, therefore, an extremely useful guide to the extensive and detailed literature concerning the natural resources of Wales, and especially to the detailed reports published by the Geological Survey and Museum. The emphasis is very definitely on the geological aspect of the mineral wealth and a working knowledge of geological terminology is assumed. Mining engineers, mining geologists and others actively concerned with the exploration and exploitation of minerals in the Principality will, probably, be disappointed with the academic bias.

D. A. Bassett

The Scottish Castle. By S. Cruden. 9 × 6. Pp. XVI + 272. 25 plans. 48 plates. Edinburgh: Thomas Nelson & Sons, 1960. 42s.

Mr Cruden has presented a comprehensive survey of all that could reasonably be regarded as falling within the scope of his title, from that "unique and enigmatic phenomenon" — that "most remarkable ancient castle in Europe" — the Broch, and from the motte which, concentrated in the river valleys of the south-west, remained the characteristic barional stronghold as late as William the Lion's reign, down to the Cromwellian forts at Leith, Ayr, Perth, Inverness and Inverlochy and the later, and remarkable, military structures of Fort William,

Fort George, Fort Augustus and Ruthven in Badenoch. While disavowing any intention of presenting a descriptive catalogue of even the more important Scottish castles, the author does in fact survey in some detail the location, architecture and functions of a large and representative number of buildings of outstanding interest and merit.

Mr Cruden adduces reasons from time to time for deprecating the traditional theory of a large "time lag" between Scottish castles and their counterparts elsewhere, and he holds that the truly ancient stone buildings in Scotland were rather older, more numerous and more worthy of study than has been thought in the past. Castle Sween *(c.* 1100) emerges as our earliest surviving stone castle, while Rothesay, he argues cogently, "substantially represents" in its present form (if with known additions) the castle besieged by the Norse in 1230. The four thirteenth-century "curtain-wall" castles of the western seaboard, Dunstaffnage, Mingarry, Tioram and Kisimul, he relates to such Lowland buildings as Loch Doon, Lochmaben and Skipness, to the more elaborate "curtain-wall with towers" (Inverlochy), the "concentric" plan of Caerlaverock, the great "gate-house" fortifications of Kildrummy, Bothwell and Dirleton (all of the thirteenth century) and on to the massive keep-gatehouse design of fourteenth century Doune and Tantallon, the baronial strongpoints (albeit residences too) *par ex ellence.*

Throughout his work, Mr Cruden emphasises considerations of plan which, in his view, has too often been accorded second place to elevation or to embellishment. He sees the later Scots baronial tower as "nothing more than the hall-house up-ended". And the tower (with Yester, built before 1267, as a forerunner) dominated Scottish castle-building from about 1330 until about 1630, though with a "long pause" in the earlier sixteenth century, marked by the building of the "palaces" of Stirling, Holyroodhouse, Falkland and Linlithgow; in the end, royal initiative over Renaissance façades and ornamentation led nowhere, and noble and laird reverted from about 1570 to their "old-fashioned" towers. The line of development is thus clear and logical from the gaunt strength of Threave, Hermitage and Craigmillar, through the "classic" — massive, secure, reticent — of Borthwick and Elphinstone to the many post-Reformation examples of "an almost perfect balance of enrichment and austerity, solid and void contrast, vertical and horizontal emphasis", such as Claypotts, Castle Menzies, Amisfield, Craigievar and Coxton. Even the multiplication of towers and wings, to give the well-known Z-plan and L-plan, is traced by Mr Cruden (following Dr Douglas Simpson) back to Huntly Castle *(c.* 1452). The theme of the true "courtyard" castle, designed and built as such, similarly leads from the Earl's Palace at Birsay (Orkney) and Barnes in East Lothian to George Heriot's hospital and Drumlanrig.

The author argues that French influences, reinforcing and enriching native inspiration, were prominent, mainly and exceptionally, in the "palatial" phase of sixteenth-century building; and that, prior to Cromwell's time, only Ravenscraig and Cadzow seem to have been planned and built with a view to withstanding assault by artillery : the defence was normally triumphant in the military sphere and only a blockade could reduce a well-manned stronghold.

Mr Cruden's valuable contribution to a subject of perennial interest concludes with a detailed bibliography, a useful index and an admirable collection of photographic plates, aptly chosen and beautifully reproduced. G. S. Pryde

Lyon, Ville Industrielle. By M. Laferrère. $9\frac{1}{2} \times 6\frac{1}{4}$. Pp. XII + 547. 32 figs. 2 tables. 3 folded maps and statistical analysis, inside back cover. Paris : Presses Universitaires de France, 1960. 30 NF.

This is the first detailed survey of the industrial structure and activity of the second most industrial town in France. The author who has specialised in economic geography is at the head of the *Comité d'Aménagement du Territoire,* dealing with the decentralisation of industries for the *département du Rhône.* His aim is not only to give a list and description of the various industries but also to show how far their organisation is determined by geographical conditions particular to Lyon. In the clear and concise introduction he rightly stresses the advantages of the situation of the town and presents an historical and descriptive view of the various districts in connection with industry and commerce. The statistics he gives

prove that the "small firm" is still the main feature of the local industry: out of 18,200 firms, 14,000 employ less than six workers. This is particularly so in the textile industry. The industries themselves are grouped under three headings, making the three parts of the book: the silk, metallurgical and chemical industries. It is the silk industry that has made Lyon famous all over the world. Monsieur Laferrère is right in adopting an historical approach, for this industry retains, even now, its traditional organisation — *la Fabrique* — which dates from the sixteenth century: and this in spite of the 1930 crisis which compelled the manufacturers to adopt artificial textiles which in recent years, for the greater part, superseded natural silk. Turning to the metallurgical industry, we are given the main stages of the growth of such firms as Berliet for the car industry, Delle or Les Cables de Lyon for electrical equipment, but the sizes of the factories and their products are so different that it becomes difficult to see any geographical determination behind it. The most important development in recent years is to be seen in the chemical industries. The biggest factories, Rhodiaceta Saint Gobain, are grouped outside the city in Saint Fond, which is thus the only homogeneous industrial area of Lyon and district. Here again the author proceeds with a study of the growth of the main firms. On the whole we are presented with both a history of the industrial development of Lyon and a geographical survey of the town in 1960. The former part will keep its interest, the latter, of course, might soon be out of date. The very good photographs, which suitably illustrate the text, also deserve commendation.

Y. Collomb

Ricerche sulle dimore rurali in Italia. Vol. 20. By Luigi Candida. *La casa rurale nella pianura e nella collina veneta.* 10 × 7. Pp. 208. 36 plates. 76 figs. 1959. *Lire* 2500. Vol. 21. By Mario Ortolani. *La casa rurale negli Abruzzi.* 10 × 7. Pp. IV + 148. 28 plates. 67 figs. 1961. *Lire* 2000. Firenze: Leo S. Olschki, for the Consiglio Nazionale delle Ricerche.

Professor Candida's volume covers an area from the Venetian Pre-alps to the lagoons and comprising at least as great variety of economy and settlement as of physical conditions. While he has himself written the general chapters and the section on the Treviso area, the areas centred on Padova, Rovigo, Venice, Verona and Vicenza have been dealt with by five collaborators. One of these, Dr Carla Cavalca, has also carried out documentary research on rural housing in the Venice area in the last five centuries and her chapter contains some fascinating illustrations from the State archives of Venice and Verona as well as references to what can be deduced from the backgrounds of Venetian Renaissance paintings.

Most of the plain between the Brenta and the Piave has the Venetian type of rural house, characterised by the portico and loggia developed, for reasons of both subsoil and trade, in the houses of the rich merchants of Venice. In its basic form the line of south-facing portico is continued in the juxtaposed quarters for the livestock. The further development, especially in the areas of more recent reclamation, of L-shaped and U-shaped variants in the pattern of accommodation for man and his livestock and the relation of structure to tenure and cropping are studied in the regional chapters. Other topics of particular interest are the relics of the thatched *casoni* in the neighbourhood of the lagoons and in the Po delta and, at the other extreme of the region, the open, south-facing galleries needed for the drying of the maize in the wetter and cooler hill borderlands.

It is a far cry regionally from the territories of the Serenissima to the mountains of the Abruzzi. There is much in Prof. Ortolani's volume to which we can find, with some modifications, parallels in some parts of Scotland. Here is the picture of an austere mountain region with a largely pastoral economy. The structure of the compact centres of populations in the mountains recalls that of Old Edinburgh. The Abruzzi are one of the most primitive regions of the Italian South, the sparse population producing less than 2 per cent of the national income. Only Calabria and Basilicata are poorer in income per head and only the latter has a higher dependence on agriculture. Feudalism survived until only a century ago and the region is still relatively isolated. Many of the settlements are reached by muletracks rather than roads. Prof. Ortolani and his fellow-workers covered

4,000 kilometres on bicycle and, as settlement in the upper Abruzzi is concentrated on hilltops, their research was *intensamente vissuta*.

More is known about the prehistoric dwellings than about those of the rural Italic ancestors of the Abruzzese. For more recent times there is little or no documentary material but the isolation and conservatism of the area make it unlikely that there has been much change during the last few centuries. In the mountain sector there is a long tradition, dating from a medieval two-field system, of fragmentation of the scarce cultivable land among small cultivating owners residing in the hill-top villages. Amongst features of special interest is the survival of the Italic monocellular stone hut in the mountains, as in the more well-known region of the *trulli* in Puglie, with which there has been a millenial connection through transhumance.

This region includes the Fùcino lake basin, familiar to classical students for the grandiose schemes of the Emperor Claudius and at last drained in 1862-75. The development of the latifondo thus created by Duca Alessandro Torlonia, the destructive earthquake of 1915 and the *legge-stralcio* (pruning or liquidating the large estates) are discussed in relation to settlements and house-types. This volume is in fact particularly interesting in showing how economic and social changes are reflected in the buildings.

The division between the large compact centres of population and empty countryside of the mountain belt on the one hand and the sub-Appennine belt of dispersed and isolated dwellings is unusually clearcut in the Abruzzi. In Aquila less than 1 per cent of the population is dispersed while in Teramo the proportion rises to 55 per cent. Dispersion was stimulated by the downfall of feudalism, the acceleration of population growth in the nineteenth century and the disappearance of malaria in the last half-century. Rapid increase in population without proportionate increase in agricultural yields was one cause of the appearance of earth and straw houses *(pinciaie)*.

Prof. Ortolani considers that the external stair of the traditional Italic two-storey house was replaced by an internal one at higher altitudes not for climatic reasons but because of the more cramped sites. In other respects too he lays emphasis on slope as a critical factor in house structure.

Both these volumes, like their predecessors in this valuable series, are abundantly illustrated with photographs and plans. C. J. Robertson

Recueil d'Études Géographiques Concernant le Territoire de la République Populaire Roumaine. By T. Morariu (Editor). $9^3/_4 \times 6^3/_4$. Pp. 178. 13 folding maps. 20 text figures. Bucarest: Éditions de l'Académie de la République Populaire Roumaine, 1960.

The geographical essays published in this volume were collected and edited in connection with the International Geographical Congress at Stockholm in 1960. These publications are becoming a practice in the Communist States of Europe, and the outcome is most interesting, and in some respects very useful.

There is a remarkable similarity about them. All are dutiful acknowledgments of the wisdom and profit of the current political regimes. The first essay in the Rumanian collection on the growth of geographical teaching in that country leaves the reader in no doubt about the acquiescence of the group of authors. "The reform of teaching in 1948 changed the general trend of instruction. Thanks to this reform higher education in geography develops in close correlation with life, with production and with the practice of appreciating socialism. Its content has been set in harmony with Marxist-Leninist doctrines and allied to the need for production".

There follows this general maxim in Rumania, as elsewhere, a heavy emphasis on physical geography. Seven out of the fourteen essays are on geomorphological and climatic topics. The marked concentration on this aspect of geography in the Communist universities might make the reader wonder whether its less controversial character makes it a healthier specialisation just now in authoritarian states. The same trend was apparent in France during the German occupation.

In Rumania there is no need to complain of such attention to physiography and climate. One essay, it is true, is devoted to new studies on a controversial topic of many years standing, the glacial morphology of the Rumanian Carpathians

The accounts of field work on the fluvial terraces, on the river systems and on the very wide subject of the Rumanian lakes are wholly welcome, for we know so little about any of them. The essays are clear summaries of the types and distributions of physical features rather than profound studies, but the accompanying black and white diagrams are clear and wholly relevant to the text. The reader can learn much from them.

Three short essays are comments on the reprints of coloured maps (natural vegetation, fauna and natural regions): the latter are probably available in this form for the first time to readers in this country. The last three on the geography of the population of Rumania, on the origin of the name "Muntenia", sometimes used for Wallachia, and on the geography of the Rumanian villages, are in a different category. The second of them is a straightforward little study on a regional name of obscure origin. The other two are somehow a little flat. A classification of villages into agricultural, industrial or a mixture of both brings no feeling of novelty or inspiration. Many geographers in many countries could thus sort out rural settlement. There are however interesting comments, even if they are not without bias, on the shifts and fluctuations of population and an apparent confidence in the power of the present regime to give to village life a new and positive vitality. In a country where most previous recipes for prosperity and stability have failed sadly, one cannot but watch with interest.

The reader might hope that further field work and publication will produce essays on the Danube delta at one extremity of the country and on the Iron Gates at the other: also some economic studies on Danube shipping, the present state of oil mining and transport and the development of the natural gas resources.

The whole collection is a good example of the kind of material that western geographers in the divided world must learn to absorb and assess. It contains, indeed, the permitted thinking and writing in a country where all education is strictly controlled. But much of it is useful because the country itself is a magnificent one for geographical studies and because almost all of the work on it is yet to be done.

H. Steers.

A Geography of Norden. By A. Sømme (Editor). 11 × 7¾. Pp. 364. Numerous figures, tables and maps. 13 coloured maps. Oslo: J. W. Cappelens Forlag, 1960. N.Kr.53.

The most memorable souvenir received by delegates to the Stockholm Congress of the I.G.U. was *A Geography of Norden.* It is edited by the doyen of Norwegian geographers, Axel Sømme, and written by a strong team of authors representing the five northern countries. Dr Margaret Davies has undertaken the task of polishing the English translation.

This regional study, now available in an English edition, is orthodox in approach, comprehensive in content and is described by its editor as "suitable for university teaching of geography abroad". The first six chapters consist of short systematic studies of the area in its entirety. They are followed by substantial chapters on each of the component countries by senior geographers from Denmark (Axel Schou and Kristian Antonsen), Finland (Helmer Smeds), Iceland (Sigurdur Thorarinsson), Norway (Tore Sund) and Sweden (Karl Erik Bergsten). Fritjof Isachsen's 'prologue' on Norden is matched by no epilogue, but the thirteen coloured maps (printed by Sweden's Esselte map service) serve as a conclusion which rises to a peak in the four population maps of Gerd Enequist. A useful introductory key to provinces and counties is balanced by helpful bibliographies and, of course, excellent photographs.

The text is a blend of old and new. Familiar facts are illumined by unfamiliar detail by contributors intimately acquainted with the country of which they write. Published materials, such as splendid block diagrams from the *Atlas of Denmark*, are reproduced beside hitherto unpublished maps such as those illustrating Finnish land improvement. The Swedish chapter offsets criticism that historical aspects of geography may have been neglected by providing a glimpse of an old cadastral map and by including sequences of distribution maps *(e.g.* from Bergslagen) at telling intervals of time. Bibliographies are unfair game for critics, but Eino Jutikkala, *Atlas of Finnish History* (Helsinki, 1949) and some contribution by the de Geer family might have been included.

In the recent past, the geographical giants of the north have been explorers such as Nansen, Nordenskiöld and Hedin. Through Viking or Varagian feat they captured the imagination of the world. They wrote less about their homelands than about distant places, but they published in internationally-known languages. Academic geographers of the five countries, investigating their contemporary problems, have followed their example. This introduction to Norden, the first comprehensive geography of their world to be written in an international language by its scholars since Olaus Magnus published his Latin masterpiece 400 years ago, will also serve a new generation of students as their introduction to its university geographers.

W. R. Mead

Norges Tettbygde Steder, 1875-1950. By H. Myklebost. 6½ × 9½. Pp. 371. Photographs, tables, and diagrams, and one coloured folding map 1 : 1,500,000. Oslo-Bergen : Universitetsforlaget, 1960.

This book is a useful addition to the growing literature on urban geography. It is particularly interesting in that it deals with a country that has few large towns, and much dispersed settlement. The author relies primarily on Ratzel's definition of a *town* as a place which includes three elements : urban economy, agglomerated settlement, and a minimum population. He coins a new Norwegian word, *tettsted*, to connote an "urban settlement" with a resident population of not less than 200, where "at least 75 per cent of the economically active population (excluding domestic services and activities unknown or inadequately described) is engaged in pursuits other than agriculture and forestry". These he discusses, bearing in mind Ratzel's definition, and classes into five types : Central Places, Communication Central Places, Industrial Central Places, Communication Towns, Industrial Towns, Fishing Towns, Other Urban Settlements. The Industrial Towns are subdivided into three types, according to the degree of specialisation. They form the largest group of towns (205), with 23 per cent of the population of Norway, but the 125 Central Places contain 62 per cent of the country's population.

There is an account of the rise, or in some cases, decline, of towns since 1875, and the towns are then discussed *Fylke* by *Fylke*, with the aid of an interesting multi-coloured map, which also shows the boundaries of Trade Regions and Districts (*Handelsområde* and *Handelsdistrikts*). It is a pity, for non-Norwegian readers, that it is not explained in the text how these boundaries were delineated; but they are taken direct from the Norwegian Central Statistical Bureau's publication, *Know your Market; Economic Directory*. The *Handelsområde* nevertheless correspond very closely with the hinterlands of Fourth Order (District) Centres, such as were delineated for Scotland by Fleming and Green in the *Scottish Geographical Magazine* for April 1952 (Vol. 68); the *Handelsdistrikts* are subdivisions of these.

The discussions of each individual *Fylke* give a very good picture of the regional human geography from a viewpoint which is not too common. The studies of the West Coast *Fylker* towns are of considerable interest and value to all those who are concerned with the development and welfare of Scotland's west coast.

The book is No. 4 of a Series entitled *Ad Novas, Skrifta fra det Norske Geografiske Selskab.*

F. H. W. Green

AFRICA

A Contribution to the Physiography of Northern Ethiopia. By Y. Abul-Haggag. 9½ × 6½. Pp. XIV + 154. 64 photographs, maps and drawings. London : The Athlone Press, University of London, 1961. 42*s*.

Dr Abul-Haggag is the Lecturer in Geography at the Ain Shams University in Cairo. As a result of his own field work during expeditions to the former Italian colony of Eritrea in 1948 and 1952 and with the extensive use of Italian and German sources, he has now produced a valuable addition to the meagre English works on Ethiopia.

The book consists of two parts; the first four chapters are a description of the surface geology, climate and vegetation, and human settlement of the area, and the remainder is a genetic study of the geormorphology. This well-produced book with its lucid drawings is therefore primarily of interest to the geomorphologist, particularly that part which attempts a denudation chronology, but the serious geographer will find the earlier part useful, although the human geography of the area is given only brief but tantalising mention. It might be hoped that the author who has sought to unravel the origins of the physical landscape would go on to relate them to the complex patterns of tribal life in the area.

R. L. Crole

The Indigenous Livestock of Eastern and Southern Africa. By I. L. Mason & J. P. Maule. 10 × 6¼. Pp. XV + 151. 3 Figs. 3 Maps. 179 Plates. Farnham Royal: Commonwealth Agricultural Bureaux, 1960. 45s.

Though the field of readers to whom this book will appeal may be somewhat limited it will be of the greatest interest and importance to all who are concerned with animal husbandry, particularly if that concern is related to "the rapidly emerging and vitally important continent of Africa". The purpose of the Authors, which seems very amply fulfilled, is to gather and collate all the information they could obtain on the native domestic livestock of eastern and southern Africa. There falls within its scope the various breeds of camel, horse, ass, cattle, sheep, goats and pigs. The book contains the fullest description of each breed with particulars of size, weight, yield in meat, milk, wool, etc., Over seventy varieties of cattle are described and they are rivalled in number by those of the sheep and goats. Many of these breeds are most picturesque, surpassing in that respect anything we have at home apart from Highland cattle; this is shown by the very impressive collection of photographs which adorn the book. There are also three maps, a number of line drawings and a bibliography which covers no less than fourteen pages. The quality of production could scarcely be higher. T. H. Gillespie

AMERICA

Late-Pleistocene Environments of North Pacific North America. By C. J. Heusser. American Geographical Society Special Publication No. 35. 9¾ × 6⅝. Pp. XXIII + 308. 49 figures, 25 plates. Burlington: Lane Press, 1960.

The study of pollen grains preserved in peat and other deposits along the Pacific coast of North America from Alaska to California is the subject of this valuable research publication. Pollen diagrams for seventy-eight sites are presented and the evidence from a further thirty-six sites is taken into account by the author in reaching his conclusions. Chapters on Late-Pleistocene physiographic events (glaciation, land-sea-level variations and vulcanism), present and past climates and vegetation provide very good summaries of the present state of knowledge of these subjects in the area and are based on numerous references cited, along with others, in a long bibliography at the end of the volume. The results of the author's pollen studies are presented in a very long chapter, which is preceded by a description of research methods in palynology, including an excellent summary of possible sources of error. The author's findings and those of other researchers are brought together in the final chapters, in which volcanic activity (represented by layers of ash in many of the peat sections) and changes in vegetation, climate and land-sea-level relations are correlated, the whole being tied to an absolute chronology by twenty-four radio-carbon dates. Comparisons are made with Late-Pleistocene changes as recorded elsewhere in North America and, in some instances, in other parts of the world. Evidence in favour of the former existence of glacial plant refugia is also presented and a brief but interesting discussion of the routes

by which early man entered North America is included, the route via Bering Strait and the Rocky Mountain front accepted by many anthropologists being considered less likely than a migration by way of Bering Strait and the Alaskan-Canadian coast.

J. B. Sissons

HUMAN GEOGRAPHY

The Human Use of the Earth. By P. L. Wagner. 8½ × 5½. Pp. XV + 270. 7 figs. Glencoe, Illinois: The Free Press. $ 6.00.

The dust jacket describes this as an "amazing book". It is something less than this, but it is an interesting and serious attempt at systematic human geography, in the tradition (as Professor Wagner readily acknowledges) of Carl Sauer, but also of Jean Brunhes. The writer, in his preface, gives a precis of his theme in the following terms: "One of a human society's most distinctive features is its creation of and dependence on artificial environments. The creation of artificial environments depends upon particular kinds of relations among men...., upon certain ways of regular interaction between men and plants and animals, and upon the vast expansion of the physical powers of the human body through the enlistment of natural forces.... The constitution of the artificial environment of a society, and the location of its components in space as the map shows them, express all of these influences and in their turn influence the lives of groups and individuals in a fundamental way". The author considers the more important of the bonds which tie together human societies, and also the means of production and the ways of obtaining a livelihood, as well as the principal features of his "artificial environment", such as routes, service centres and industrial locations. J. H. Paterson

The Wildbooters. By F. Kern. 8½ × 5¼. Pp. XI + 204. Edinburgh: Oliver & Boyd, 1960. 21s.

This work, translated from the German, attempts to reconstruct the earliest human culture in the food-gathering and hunting stage. The word Wildbooter (from the German *Wildbeuter)* is coined to replace the clumsy phrase "hunters fishers and food-collectors". Kern sees his Wildbooters in the light of his own theories. It is true that he uses existing food-gatherers — the Ituri pygmies, the Chinchus of India and the Yamenas of Tierra del Fuego — to illustrate the economy, society, and religious ideas of his original Wildbooters, but there is always the suspicion that if they display any features which do not fit in these are dismissed as borrowals. There is an idyllic quality about the original Wildbooters which recalls old notions of the noble savage. Following Schmidt, they are considered to have been monotheistic. "The conception of a God and Father who is one and invisible God of the universe belongs to the earliest Wildbooter civilisation *(sic)*". They are neither patriarchal nor matriarchal; they marry for love; the nuclear family is the unit of society; the lone hunter is glorified and natural law and justice originated in this primitive world. This is an interesting work, but fact and opinion are so freely mixed that the reader can hardly separate them.

E. E. Evans

EDUCATIONAL

The Mediterranean Lands, Advanced Level Geography, Book II. By H. Robinson. 8½ × 5¼. Pp. VIII + 468. 93 figs. 41 plates and 22 tables. London: The University Tutorial Press, 1960. 21s.

This is a text book *par excellence,* both a remarkably comprehensive source of facts for teachers and a book which will really 'teach' the Sixth-Former, set to

work on his own. It covers all countries of Europe, Asia and Africa which have a Mediterranean seaboard; first considering systematically the geography of these countries as a whole, and following with a regional treatment of each state which includes both a general description of the country and a detailed analysis of each region within it. In both systematic and regional chapters structure and relief are dealt with very simply. Material on climate, vegetation, soils, etc., is fully adequate for school purposes, while economic, social and historic topics get much fuller treatment than is common in school texts.

Unfortunately the book is thorough at the expense of length, and some sections of the systematic material are so elementary as to be irritating to a pupil who has long since mastered them (e.g. a five-page dissertation in general terms on irrigation). The introduction says that "....a certain amount of repetition has been deliberately aimed at", but in some cases (as in Greece) by the time one reaches the detailed regional accounts about half the text seems to be repetition.

Despite these drawbacks this is an attractive book, in places very concisely written (*e.g.* the physical geography of Italy). It presents much material otherwise available to pupils only in university texts, includes a great many evocative quotations from earlier books, and has useful reference lists for further reading. For university students it is too restrictedly factual, a common difficulty with books designed for English 'A' Level courses. It should find a place in Scottish Sixth Forms and Colleges of Education.

A. A. M. Hogg

The United States of America. By W. R. Mead & D. C. Large. How People Live Series. 8½ × 6½. Pp.104. 26 figures. 28 photographs. London: Educational Supply Association Ltd., 1961. 8s 6d.

Each book in this series presents the geography of a country through examples of the everyday life of children living in various parts of it. In this book the choice of areas and families has been made extremely skilfully. Practically all aspects of American farming normally presented in regional textbooks are covered. Coal, oil, iron ore and forestry are introduced and the essential roles of transport and manufacturing in the American way of life are spotlighted. The diversity of origin of the American people is stressed; also the unifying influences of the culture which they have developed.

Despite its cost this book is worth considering as a class text. Its highly descriptive language and clearly drawn local plans and location maps will appeal to the more intelligent classes of First or Second Years. Other schools will want copies for library use or as a basis for 'project' studies.

A. A. M. Hogg

Geography In and Out of School. Suggestions for the Teaching of Geography in Secondary Schools. By E. W. H. Briault and D. W. Shave. 7¾ × 5. Pp. 199. 5 plates. 19 maps and diagrams. London: Geo. G. Harrap & Co. Ltd, 1960. 9s. 6d.

For some years we have had the benefit of advice by these authors in the report *Geography in Secondary Schools* published by The Geographical Association. Now, their experience and judgement have been deployed more fully, and, though still directed at the teacher of children of average ability, rather than those preparing candidates for external examination, this book has a strong, clear message for all teachers of the subject. As the title suggests, open-air geography is given a very full share of attention. In this respect, and in promoting with realism and common sense such modern theory as the value of a concentric syllabus, there is no narrow concern with any one age-group or ability-range. Such theory, as these authors recognise, is never wholly new, but always in need of re-statement and re-alignment, and it gains authority in this book from its own moderation: there is no extreme of fashion, no mere fancy or frill advocated here; the facts of geography are respected and their inculcation given thoughtful support.

This is a textbook for the student, the novice, or any geography teacher who is free from both the mental habits of over-formal classwork, and from the practical limits of an over-loaded syllabus. It will be welcomed by those who hope that the new curricular planning and examination structure in Senior Secondary

Schools in Scotland will be an opportunity for new thinking, and some pruning, when the content of the geography course is being planned. "Quality rather than quantity" is implicit in this book, and while one might want more detail and fuller documentation in places (*e.g.* making and using objective tests) one could hardly look for a more concise and firm statement of what secondary school geography should be.

C. E. Brown

CARTOGRAPHY AND PHOTOGRAMMETRY

Manual of Photographic Interpretation. By American Society of Photogrammetry. 10 × 6¾. Pp. XV + 868. 613 figures (including some 600 black and white and colour plates). Washington : American Society of Photogrammetry, 1960. 105s.

Successful photographic interpretation calls for knowledge of photographic characteristics and techniques together with a wide background knowledge of the subject being studied. The introductory chapters of this manual, which deal with the fundamentals and development of interpretation and the procurement of aerial photography, provide a sound basis for the subsequent study of particular applications of interpretation. The core of the book consists of chapters dealing separately with interpretation in the fields of geology, soils, engineering, forestry, wildlife management, range management, hydrology, agriculture, urban-area analysis, archaeology and geography. In each chapter appropriate background information concerning the field of study is presented in condensed form. This sometimes leads to repetition, as in Chapters 4, 5, 6 and 10 each of which contains brief outlines of some aspects of geomorphology.

The chapter upon soils adopts an engineering viewpoint and is concerned with parent materials rather than soils. Many pedologists will question the claims made in this chapter that soil texture can be determined by reference to photographic tone and landform characteristics. They will find, however, that the discussion of soils in the chapter on agriculture, together with the appendix by Dr Buringh, presents a realistic view of the severe problems involved in the interpretation of soil conditions.

Some of the topics discussed in this book appear to be only marginally suitable for study by photographic interpretation *e.g.* identification of corrosive soils. However, the limitations of interpretation usually receive careful attention and the difficulties facing the interpreter are thoughtfully discussed by several of the ninety or so contributors. Several writers draw attention to the fact that some classifications developed from ground observations are unsuitable for use in photographic interpretation *e.g.* land use classifications. As a result the interpreter may need to adapt or modify existing classifications to meet the special requirements of photographic analysis. This aspect of interpretation needs further careful study.

The illustrations generally fulfill their stated purpose although some of the stereo-pairs lose definition when viewed under a lens-stereoscope. Colour reproductions provide useful examples of the possible uses of camouflage detection and colour films. All readers will value the unusually detailed bibliographies given at the end of each chapter (that for Geology occupies 46 pages).

While providing useful fundamental information for the beginner this book will prove even more rewarding for the experienced interpreter. It is likely to remain a standard reference for many years.

L. F. Curtis

An Introduction to Mapwork and Practical Geography. By J. Bygott, revised by D. C. Money. 8 × 6½. Pp. VIII + 264. 164 figures. London : University Tutorial Press, 7th edition, 1960. 17s.

Bygott has long been a standard text and its general excellence has been attested by the many editions and reprints which have appeared since its original

publication in 1934. The appearance, therefore, of a seventh edition, reset and revised, with a new order of presentation and a new chapter on aerial survey is an important event.

In presentation the main change is the division into three parts entitled Map Making, Map Reading and Map Projections. Since one can define three successive phases—surveying, cartographic and interpretative—in the analysis of the earth's surface patterns, this rearrangement seems reasonable with the thought that the projection section should, then, lie between the other two.

The Map Making section occupies eighty-seven pages and considerable internal rearrangement has taken place. Both in its new arrangement and content this section is disappointing and falls below the standard of the succeeding two. The old arrangement was a logical one, conforming to the surveyors' maxim of "working from the whole to the part". It recognised also the need for the geographer to know something of how the maps he uses are made. The new edition deals with the level, clinometers and contouring before the fundamental framework is discussed; no clear distinction is made between precise and inaccurate work, nor is the order of surveying procedure made clear.

The general air of the section, too, is still that of thirty years ago from the point of view of instruments and methods; an impression reinforced by the recommended books on surveying and by the references to boundary commissions, native rule and active service. The revolutionary changes in map-making techniques of the past fifteen years are passed over almost entirely, the new chapter of four pages on aerial surveying, meant to plug this gap, being quite inadequate and, in this form, better omitted.

Turning to the second part, the author and reviser seem much more at home. Here, in dealing with the setting of a map, the various interpretative aspects of physical geography, land use, human geography etc., the ground is well covered. There are, however, occasional lapses in the text and in diagrams 80 and 81, both of which lack a vital contour and in the latter a river is shown flowing uphill over part of its course. The simple analyses of representative areas are well done and the students' powers of interpretation should be developed by the well-designed practical exercises which now follow each chapter.

The final section on Map Projections is also competently covered, the rearrangement and the inclusion of some well-known projections missed in earlier editions being changes for the better.

To dwell on the shortcomings of the first section at length when the other sections are well described is perhaps rather unjust but the status of the whole book must suffer unless it undergoes considerable revision in this section.

G. Petrie

MAPS AND ATLASES

Britische Inseln, Frankreich, Belgien, Niederlande, Luxemburg, Wirtschaftshistorische Entwicklung. Historisch Geographisches Kartenwerk. By E. Lehmann, W. Schmeer, R. Ogrissek and H. Weisse. Folder 16 × 11. Pp. 53, text, 28 maps. Leipzig : Verlag Enzyklopädie, 1960. DM 150.

The present folder of 28 sheets is part of a larger work, of which the Indian volume has already been published. The emphasis is on distribution maps of interest to the economic and social historian. The 191 maps cover Benelux, France and the British Isles (57 maps) and their colonial possessions (9 maps of British Colonies). Selection of topics appears haphazard but seems governed by availability of suitable and easily plottable source material. An introductory text volume describes each map and includes a copious source bibliography. The maps are nicely and colourfully executed; but the compilers have sought to include too much information, so that the maps are frequently overcrowded. While Western sources of information have been used, the text and maps savour strongly of Marxist-Leninism. The colonial maps are cast in particular to show colonialism in its worst

light, while even the other maps tend to stress the economic and social plight of the workers and to remind the user constantly of the classical Marxist concept of the class struggle. The volume is interesting as "the other side of the story".

R. E. H. Mellor

Economic Atlas of the Soviet Union. By G. Kish. $10^1/_2 \times 10^1/_2$. Pp. 96. 64 maps. 2 end-paper maps. Ann Arbor : The University of Michigan Press, 1960. $ 10.00.

George Kish of the University of Michigan has produced a useful study and research tool for students of the geography and economy of the Soviet Union. Unlike previous economic atlases of the Soviet Union, this one emphasises the regional approach. Only five general maps apply to the country as a whole. They deal with physical features, vegetation zones, administrative divisions, air transportation and population distribution. The bulk of the atlas is made up of sixty regional maps, divided into groups of four, each group devoted to one of the fifteen principal economic regions of the USSR. The regional maps deal with agriculture, minerals, industrial location, and transportation and cities. Each regional section is preceded by a concise descriptive text stressing the historical evolution of the region under discussion.

Spot checking discloses a high degree of accuracy in the presentation of factual data. Place-names are judiciously selected and properly spelled, in the transliteration system used both by the Board on Geographic Names of the United States and the Permanent Committee on Geographical Names of the United Kingdom. An evident effort has been made to keep up with the frequent name changes that plague students of the Soviet Union. The visual appearance of the maps in two colours — brown and black — is somewhat dull, but the high cost of colour-printing evidently ruled out a more lively colour scheme.

Inevitably Professor Kish's atlas invites comparison with the last important economic atlas of the Soviet Union, published in 1956 as part of the Oxford Regional Economic Atlas series. The Oxford atlas, except for regional reference maps, consisted of topical maps covering the entire Soviet Union and Eastern Europe. The research incorporated into the Oxford atlas was of a far more detailed and technical character than the data presented in Professor Kish's work. On the other hand, the Michigan atlas was able to take advantage of the publication of a vast amount of new Soviet data in recent years as the veils of secrecy that hid many aspects of the Soviet economy were lifted. With its pronounced regional approach and up-to-date content, Professor Kish's work serves as a welcome supplement to the Oxford atlas, especially for students.

T. Shabad

A Historical Atlas of Canada. Edited by D. G. G. Kerr. $12^1/_4 \times 9^1/_4$. Pp. IX + 120. Toronto : Thomas Nelson & Sons Ltd, 1960. $ 5.00.

The title of this excellent volume gives an inadequate impression of its contents. Its 154 map reproductions, maps and diagrams not only tell the story of the exploration of Canada from its earliest beginnings to the Arctic voyages of the twentieth century, but also cover such topics as the exploits of Canadian armies overseas and the evolution of the economy as revealed in statistical diagrams. Thus there are to be found here reproductions of some early maps, such as Champlain's (1612 and 1632), alongside maps of present agricultural distributions or forest cover, and, to finish the book in the style of the nineteen-sixties, a map of the St Lawrence Seaway. The last of the six parts that make up the atlas is called "Main Economic and Political Trends since 1867", and its 33 diagrams trace developments in the field of population statistics, finance, government and resource use up to 1956. Under the innocent title of "Historical Atlas", therefore, the battle of Vimy Ridge, the "pole miles of telegraph line" and the distribution of Slavic immigrants alike receive attention.

If the present volume were to be regarded as the poor man's version of the official 1957 Atlas of Canada, little injustice would be done to either publication. The format and cartography are both unusually pleasing, and the explanatory text which accompanies most of the maps gives brief but clear point to the cartography. This is a volume to be highly recommended.

J. H. Paterson

Atlas of Australian Resources. Prepared by the Department of National Development, Canberra. 1953-60.

With the five new map-sheets published in 1960 the Department of National Development, Canberra, has completed the *Atlas of Australian Resources* on which work began in 1951. The first ten map-sheets were reviewed in this journal some years ago (*S.G.M.*, 1955, 71, 127-128). The Atlas comprises 30 map-sheets, each accompanied by a commentary. Some of these commentaries contain additional small maps as well as statistics, diagrams and text, generally compiled by experts in the appropriate Government departments. The original editor, K. Frenzel, has had two successors, Anne F. T. Bauer and T. W. Plumb.

In many of the maps shape, size and colour of symbol have been very skilfully used against different gradations of areal colouring to show both absolute and relative values for both punctiform and diffuse distributions. Thus, among the new maps, that on immigration, using two gradations of each colour, combines density of population with immigrant percentages and adds dots to indicate the number of immigrants. Again, in the Croplands sheet not only the individual crop but its type and its area are represented in a single symbol. In the Mineral Industry sheet size of symbol indicates proportion of total production, colour represents total value of output, segmentation of the symbol the stages of treatment carried out on the spot, while by-products are indicated by attachments to the main symbol.

Amongst the transportation maps that on ports and shipping is particularly notable for the large amount of information successfully incorporated: it shows for each port the number of berths and the depth of water, the hinterland, the type of cargo, the tonnages of imports and exports overseas and Australian, arrivals and departures of passengers overseas and local, and shipyards. Although a simpler map, that of distribution of livestock usefully combines numbers of stock with pasture types and isohyets. On the other hand more might have been shown on the map of health services, while the maps in which increase of population in urban areas is shown might have been improved by a combination of size and colour of symbol to indicate both absolute population and rate of increase.

It would have been useful to have a few larger-scale regional maps of the main urban-industrial regions, in which the wealth of material might have been more fully integrated. In all however the Department of National Development is to be congratulated not only on the completion of this very timely project but on its readiness to experiment with new methods of portraying economic phenomena cartographically and on the aesthetic quality of most of the map-sheets.

C. J. Robertson

Atlas du Maroc. By the Comité de Géographie du Maroc. 15 sheets, each 64 × 50 cms. with accompanying descriptive handbooks. Rabat: Institut Scientifique Chérifien, 1956 in continuation.

This is a series of loose maps, with explanatory handbooks each of 30-40 pages; and so far fifteen sheets covering five topics have appeared. Style recalls that of the *Atlas de France*, and there is the overall intention of producing maps on some 54 separate topics that will cover all elements of the physical, human and economic geography from topography, climate and geology to disease vectors and economic development—altogether between 150 and 200 maps are envisaged. The maps are in general well-produced technically—the fact that Professor Gaussen is one contributor will be a sufficient indication as to quality—and the handbooks add considerably to the value of the atlas, almost amounting in themselves to a succinct geographical text.

Much data is already given on an area about which it has been hitherto difficult to obtain detailed information; and the National Committee is to be congratulated on its energy, initiative and comprehensive planning. One drawback however to any elaborate scheme for a national atlas is apparent here—much of the information, especially on the human and economic sides, becomes rapidly out of date, and

overtaken by later developments. As well, with Morocco, there must be some uncertainty regarding the extent and reliability of basic data—though the devoted work of many individuals over long periods is clearly apparent in several maps. Hence several (though by no means all) of the maps appear somewhat empty : one feels that these might with advantage have been reduced in size, especially those dealing with economic matters. Nevertheless, publication of an atlas on such a scale is both timely and remarkable : and a matter that we in Britain could well mark and ponder.

W. B. Fisher

Ghana Population Atlas. By T. E. Hilton. 16 × 12. Pp. 40. 17 figs. 6 tables. Edinburgh : Thomas Nelson & Sons for the University College of Ghana, 1960. 50s.

This is one of the most important detailed demographic studies to come from a tropical territory since the last war. By dint of long search upon the ground for the places named in the censuses of 1931 and 1948 Dr Hilton becomes the first and, so far, the only person to realise fully the information within these documents. He has presented the facts for 1931 and 1948 at a scale of 1 : 1,500,000 in accurate dot-distribution maps (1 dot represents 200 persons) and for 1948 by choropleths of density. Other maps at a scale of 1 : 3,00,000 show densities by districts for 1921, 1931 and 1948, percentage changes by districts for the periods 1921-31, 1931-48, followed by 'pie-graphs' of male occupations and birth-places. Another most useful function of the atlas is to bring together maps which hitherto have been obscurely placed — those showing the difference in closed forest area between 1908 and 1953 prepared by the late Dr C. S. Charter for the Cocoa Conference of 1953 and others showing cocoa production (1 dot represents 100 tons) for 1928 and and 1951.

In the text which follows the maps, Dr Hilton first assesses the quality of each census since 1891 and then each of the main territories is discussed in detail beginning with the history of population changes as a preliminary to the present density distribution. The whole discussion is intimately bound up with every aspect of the historical, economic and social geography and since the author has necessarily assumed considerable knowledge of these and of the whereabouts of tribal names and tribal districts, place names, topographic features and geological boundaries, it must be emphasised for the sake of the general reader, that the text is far from easy going. Only one major attempt at tabulation or summary of influences is made in the case of the causes of depopulation in the far north. For the rest the reader himself must search amongst many new and striking facts if he is to achieve the desired large-scale view of cause and effect. Having done so he will be rewarded with a better idea of the geography of Ghana than from any other document and will have gained an understanding of the viewpoint of those who well-nigh despair of any rapid change in the pace of development of these and like regions.

In fairness it is to be hoped that these unique maps become part of a new and long overdue national atlas of Ghana where most of the textual difficulties mentioned above could be resolved by other maps.

R. W. Clayton

The Large Scale County Maps of the British Isles, 1596-1850. A Union List. By E. M. Rodger. $9^3/_4$ × 6. Pp. XX + 52. Oxford : The Bodleian Library, 1960. 7s. 6d.

To many, catalogues make dull reading but it must be remembered that the Union List and Bibliography are to the researcher what the knife and fork are to the gourmet. With a greater interest than ever before in early maps, it is vital that those assessing them must have more aids and Miss Rodger's list is in this respect very welcome. It is significant that this work has grown out of previous lists and it is to be hoped that the author will not rest satisfied with her work as it stands for such compilation is an unending task.

The list is arranged by countries and by chronological order within the countries. As far as the work goes it is quite satisfactory but it can be looked upon only as a starting point for a complete Union List of the county maps of the British Isles. In England, Miss Rodger has amassed a considerable list — the entries here comprise three-quarters of the whole book — but in Scotland, and perhaps more, in Ireland, there are several gaps in the list. Little hint is given, moreover, of the presence of the R.S.G.S. collection of early maps. In some counties, for instance Inverness, the only maps mentioned are the Ordnance Survey 1st edition one-inch maps whereas the Society's publications, *The Early Maps of Scotland*, Edinburgh, 1936, lists several earlier maps which might perhaps have been included. No maps at all are mentioned of the County of Bute. In the entries devoted to Ireland one-third show only Ordnance Survey one-inch maps and of the total ninety-one entries only thirty-six have dates ascribed to them. The question of county nomenclature too proves a thorny one and, in Scotland, there are various inconsistancies with the author apparently giving preference to the ninteenth century names; Miss Rodger would be better advised to adopt current usage which, in many cases, relates more easily to the old names.

It is to be hoped that Miss Rodger will be encouraged by this list to continue her valuable work and to enlarge it from time to time as the compilation of such a reference work is a continuous job whose value increases from year to year.

I. A. G. Kinniburgh

Nine Glacier Maps, Northwestern North America. American Geographical Society Special Publication No. 34. 1 : 10,000.

1. Lemon Creek Glacier, Alaska. 2. Blue Glacier, Mt. Olympus, Washington. 3. Polychrome Glacier, Alaska. 4. West Gulkana Glacier, Alaska. 5. Worthington Glacier, Alaska. 6. Little Jarvis Glacier, Alaska. 7. Bear Lake Glacier, Alaska. 8. Chikuminuk Glacier, Alaska. 9. McCall Glacier, Alaska. Text 10 × 7½. Pp. 22. 1 map, 15 photographs. New York : The American Geographical Society of New York, 1960.

With the appearance of the 1 : 10,000 sheet of Mount McKinley (Alaska), the 1 : 25,000 sheet of Salmon Glacier (British Columbia) and the 1 : 10,000 sheet of the Aletsch Glacier (Switzerland), 1960 has been a vintage year for maps of glaciers. Now the American Geographical Society make a further considerable addition with their issue of *Nine Glacier Maps of Northwestern North America*, part of their contribution to an I.G.Y. programme which involved mapping glaciers all over the Northern Hemisphere. To European surveyors, mapping the complicated features of a glacier is one of the classical ways of employing terrestrial photogrammetry using a photo-theodolite. A break has however been made with this tradition in the A.G.S. maps by the use of aerial photographs for the basic material — made possible only by the co-operation of the U.S. Navy and regular government mapping agencies.

The feeling one occasionally gets from a glacier map, that it is merely a cloak behind which mountaineers and explorers exercise their true enthusiasms with rather bad results in the final product, does not arise here. The work of supplying the ground control in the very difficult terrain covered and of plotting the photographs on instruments belonging to the Ohio State University appears to have been done in a professional and technically excellent manner, clearly described in the well-produced brochure which accompanies the maps. This will be a great encouragement for those surveyors of the future who will bring out the full value of these sheets by resurveying them.

The published maps at the uniform 1 : 10,000 scale have been printed in blue and brown. The Aletsch and Mount McKinley sheets mentioned above immediately come to mind for comparison. The Swiss as a matter of course adorn their maps with striking and effective hill-shading, and the Aletsch sheet is no exception. Their skill was even more lavishly applied to the Mount McKinley sheet, conceived as a cartographic *tour-de-force* as well as an invaluable record of the topographic situation. But the cost of this delightful decoration is substantial and no criticism can really be made of the A.G.S. for not incurring it. These nine sheets show in a simple and very clear way the results of a piece of specialised mapping whose value, already considerable, will be even greater in the future.

G. Petrie.

Ordnance Survey 1 : 25,000 Provisional Edition, Ilfracombe Sheet No. 856. 30 × 40$^{3}/_{4}$. Ordnance Survey : Chessington, 1961. Paper flat 6s. Paper folded 6s. 6d.

This 1 : 25,000 sheet of the Ilfracombe district, covering a very popular holiday area on the North Devon coast, has been produced as an experimental sheet in a new style by the Ordnance Survey. In case the reader raises his hopes that the area would be treated in the stimulating way the Survey has treated other tourist areas on the one-inch scale, let him at once be brought down to earth. The new features are much more mundane. One is an increase in the sheet size so that the area covered is 20 km. (east-west) X 15 km. (north-south) instead of the 10 km. square previously standard at this scale. The other is the scrapping of the cardboard cover and the printing of the cover design at one corner of the sheet so that, when folded, it acts as a cover.

Both of these features are in line with current trends. The increase in sheet sizes has already occurred in the Survey's large-scale series and the discarding of the cardboard cover follows continental practice. The bigger sheet-size is an advantage, but one suspects that the chief reason for these changes is to keep down costs of production and as such they are to be commended.

From the cartographic point of view, the reviewer only notices the printing of the woods in a light green as being different from usual. Curiously, no record of the magnetic declination appears and the numbering of the sheet goes without explanation, having no apparent relation to the accepted numbering for this series.

The Ordnance Survey has missed a big chance in not tackling this experimental sheet in a more spirited way, particularly with regard to the representation of relief. The smaller-scale one-inch and quarter-inch special sheets have brought the Survey nothing but praise and attention. As recently we have also had some very undistinguished sheets at six-inch scale of part of the far north-west of Scotland, which called out for the application of the hill-shading techniques which the Survey so obviously possesses, but did not receive it, it would seem that the Ordnance Survey must look to its laurels at medium scales. Certainly the tourist sheet of the Cuillins of Skye at a medium scale suggested by a reviewer in a previous edition of this magazine *(S.G.M. Vol. 75 No. 1)* would be a welcome tonic.

G. Petrie

How to Use an Atlas : With Answers. By L. F. Hobley & G. R. Davies. 6$^{1}/_{2}$ × 4$^{1}/_{4}$. Pp. 136. Numerous illustrations. Glasgow : Blackie & Son, 1960. 4s. 9d.

Copies of this book will be found most acceptable in many schools. Its aim in training pupils to read and understand atlas maps is to be commended, for ignorance in using atlases is far too widespread.

The method of approach stimulates interest from the beginning. Sections on "Size and shape of maps", "Different kinds of maps" etc., are explained in simple and lucid terms. There is a very worthwhile illustrated section on abbreviations such as "Arch. - Archipelago", "C. - Cape" etc., which will give the less able pupil in particular much greater confidence when confronted with a sea of words on an atlas page.

Some of the exercises are based on the explanatory sections alone and deal for instance with "Time", "Scale", "Latitude", and "Longitude", while others are of a general nature concerning themselves with a particular country or region. The exercises on countries are varied and provide excellent practice in all aspects of using an atlas.

M. W. Gough.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY
PROCEEDINGS

Meetings of Council were held on 8th June and 29th June, 1961.

Obituaries: The Council regrets to announce the deaths of Dr C. A. Malcolm, Hon. Librarian since 1943, and Mr H. Skelton, Council member since 1945.

ANNUAL GENERAL MEETING

The Annual General Meeting will be held in the Society's Rooms, Edinburgh, on Tuesday, 10th October, 1961.

ANNUAL SUMMER EXCURSION

This Excursion took the form of a visit to the Isle of Arran on Saturday, 3rd June, 1961. The party travelled from Glasgow by train and steamer, followed by a coach tour round the island.

SOCIETY'S TOURS

During the months of June to August 273 members of the Society took part in tours to Scandinavia, Iceland, Eastern U.S.A. and Canada, the Rocky Mountains National Parks and Grand Canyon.

CONTRIBUTORS TO S.G.M. VOL. 77 (2) SEPTEMBER, 1961

STEPHANE DE BROMMER — Ingénieur en Chef Géographe, l'Institut Géographique National de France.

R. A. GAILEY — The Ulster Folk Museum, Belfast.

R. W. GALLOWAY — Division of Land Research and Regional Survey, Commonwealth Scientific and Industrial Research Organisation, Canberra, Australia.

J. D. W. MCQUEEN — Department of Geography, The University of Glasgow.

H. A. MOISLEY — Department of Geography, The University of Glasgow.

JOHN L. NOWLAND — Lately Research Assistant, University of Istanbul.

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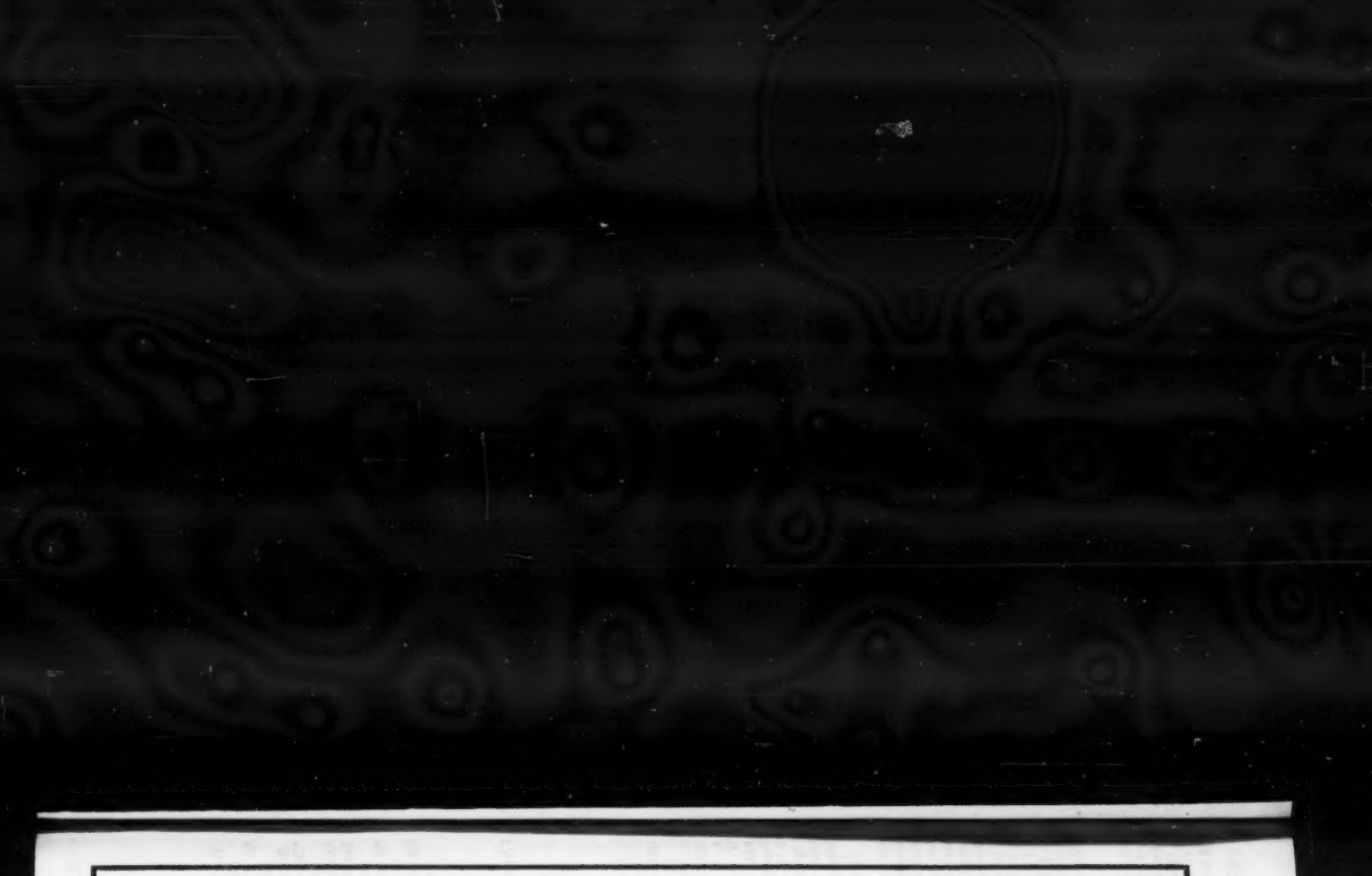

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